

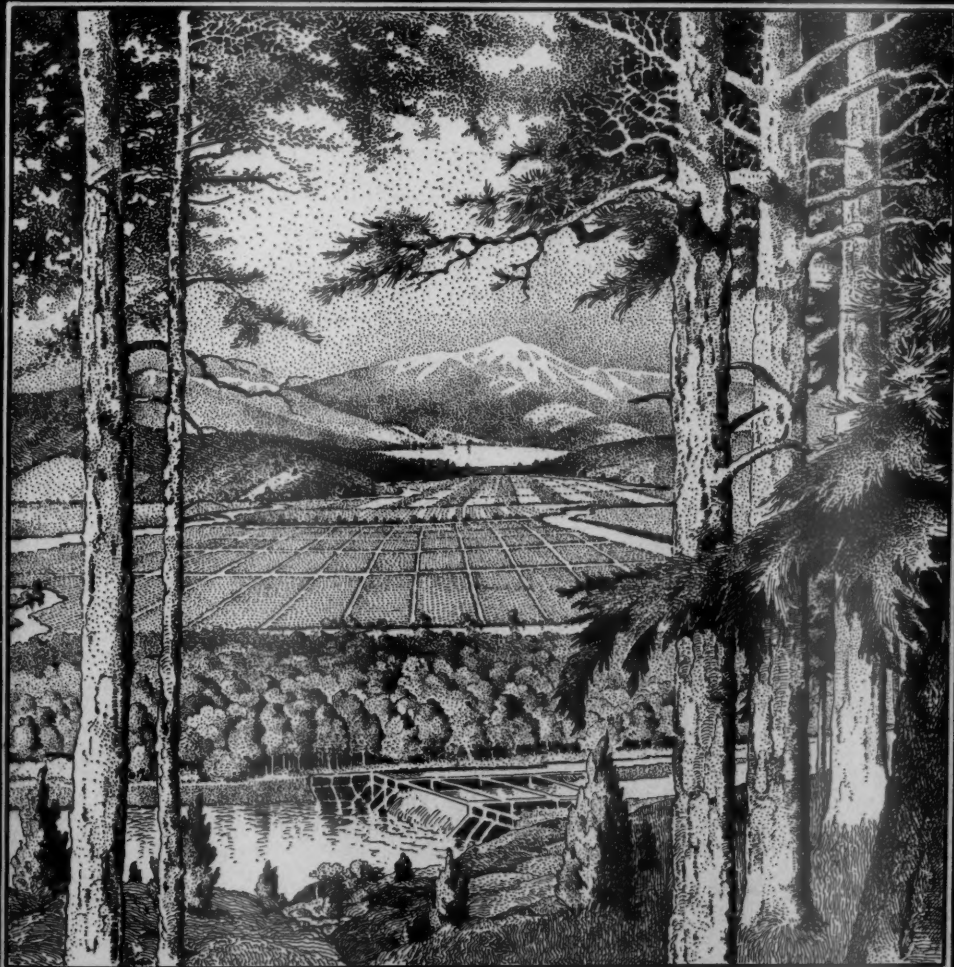
American Forestry Association Meets at Minneapolis, Aug. 25-26

Vol. IX—No. 8

AUGUST, 1903

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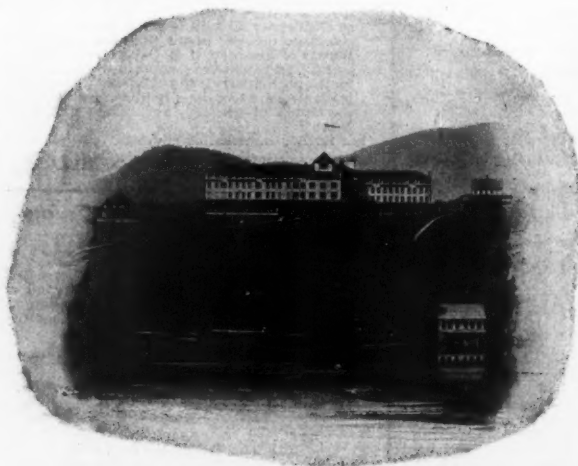
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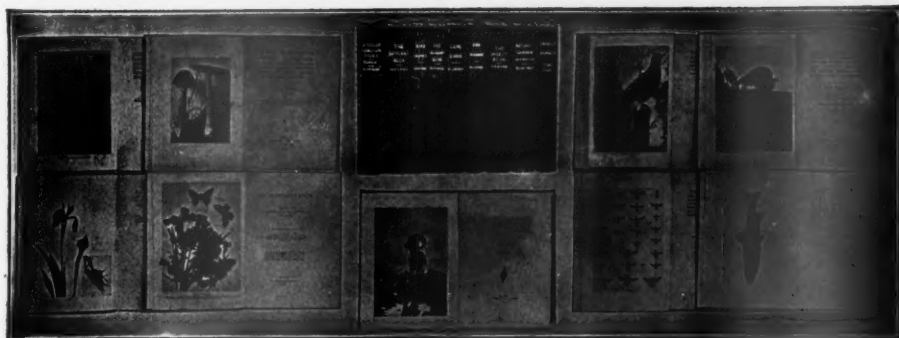
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1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

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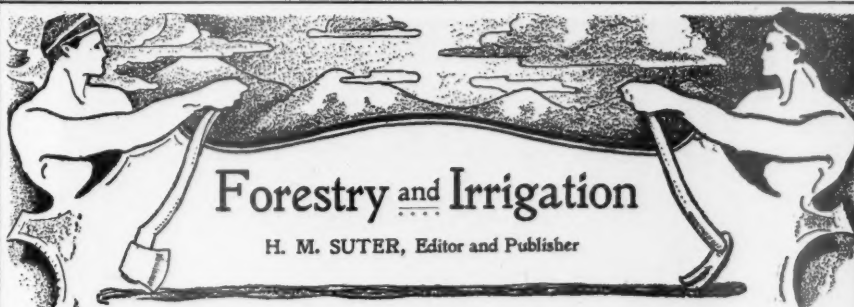
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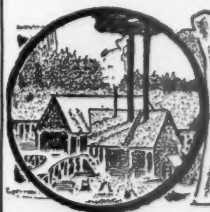
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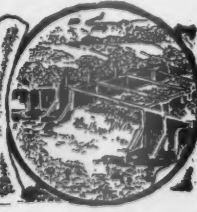
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UPPER DAM ON OTAV CREEK, NEAR SAN DIEGO, CALIFORNIA, LOOKING ACROSS THE CANYON. THIS AND THE SWEETWATER AND BEAR VALLEY DAMS, ALL IN SOUTHERN CALIFORNIA, ARE CURVED, WITH ARCH UPSTREAM. (SEE PAGE 411.)

Forestry and Irrigation.

VOL. IX.

AUGUST, 1903.

No. 8.

NEWS AND NOTES.

American Forestry Association Meeting.

Plans for the summer meeting of the American Forestry Association, which is to be held at Minneapolis, Minn., August 25-26, are nearly perfected. The most important subject to be considered at the meeting is the work of the Bureau of Forestry in connection with the Minnesota Forest Reserve. A paper setting forth the Bureau's plans will be read by Mr. Eugene Bruce.

The convention will be opened at 10 a. m. Tuesday, August 25, in the rooms of the Minneapolis Commercial Club, Andrus Building, corner of Fifth and Nicollet avenues. General C. C. Andrews, Chief Fire Warden of Minnesota, will deliver the opening address, followed by a talk on "Minnesota Parks and their Relation to Forestry," by W. A. Douglas, Attorney General of Minnesota. Tuesday afternoon papers will be given by Overton W. Price, Bureau of Forestry, on "Government Aid to Private Forestry;" "Taxation and Private Forestry," by Prof. Ernest Bruncken, ex-secretary of the Wisconsin Forest Commission; "Forest Courses in Agricultural Colleges," by Prof. S. B. Green, University of Minnesota; "Tree Planting on Minnesota Prairies," by Geo. L. Clothier, Bureau of Forestry. All of these papers will be thoroughly discussed. On Tuesday evening the Commercial Club of Minneapolis will entertain the delegates with an excursion to Lake Minnetonka, supper and boat rides. Wednesday morning will be devoted exclusively to the consideration of Mr. Bruce's paper on the Minnesota Reserve, which will be discussed by practical lumbermen. At the afternoon session, Hon. E. A.

Bowers, Secretary of the Association, will present a paper on "The Future of the Forest Reserves," and Professor Filibert Roth is expected to discuss "Possibilities of Reforestation in the White Pine Belt," with special reference to the Minnesota Reserve. Hon. Chas. W. Garfield, President of the Michigan Forest Commission, will talk on "The Michigan Forest Reserve;" Prof. C. W. Hall, University of Minnesota, has promised a paper on "Geological Features of Water Control in the Upper Mississippi Valley." On Wednesday evening, the President of the American Forestry Association, Hon. James Wilson, Secretary of Agriculture, will address a public meeting in the interests of forestry, and Governor Van Sant of Minnesota will also deliver an address.

There will be no scheduled excursion to the Forest Reserve, but the trip should prove interesting to any one wishing to take it. The only lumbering that has been done was under the old law of "dead and down timber," and most of the pine stands today as virgin timber. Much of this will be seen for the last time this summer, though under the reserve law some 12,000 acres are forever preserved.

The West Hotel, corner Sixth and Hennepin avenues, will be the headquarters of the Association. Address all inquiries to Herman H. Chapman, 593 Holly Avenue, St. Paul, Minn.

The Works Bill.

Contentions over irrigation legislation in California have centered around the so-called "Works" bill, and it is understood that in spite of the op-

position this measure encountered at the last session of the legislature, it will be presented again this fall. In the meantime the opposition to it is growing, that opposition being based on the principle of the joint ownership of land and water—to have the water-users the actual owners of canals and reservoirs. Wm. E. Smythe recently made an address on this subject before the Woman's Club of Los Angeles, in which he called attention to the possibility of state and government aid to irrigation reclamation under the provisions of the National Irrigation Act. Such a system of public works would not only provide for the storage and distribution of water, but also for the development of water power for electricity, which might be made available for pumping water from wells and for other industrial purposes, as is to be done with the Salt River Valley project in Arizona.

Forestry in Sarawak.

The country of Sarawak, Island of Borneo, is best known to the rest of the world through the exploits of the first Rajah Brooke, an Englishman, who, unaided and alone, took a Malayan province in the throes of internal war, and by his force and foresight made an independent nation of it, and giving at the same time the best example of European government of Asiatics. The present Rajah, nephew of the great Rajah Brooke, is following the policy of his predecessor in taking an interest in everything that concerns the welfare of his people, from the most trivial to the most serious. Among other things, he has taken an interest in forest preservation, as explained in the subjoined report, reprinted from the *Outlook*:

"A meeting of the council was convened this day. His Highness, the Rajah, informed the members he had what he considered an important matter to lay before them in reference to the future supply of timber for building purposes. At present large quantities of different kinds of woods are being felled immediately in the vicinity of the principal town, for export; and a trade had sprung up which threatened to de-

spoil the forests of all the best and most useful woods necessary to the inhabitants of a growing town. At this end of the state, where so much wood is now being worked for export, the country is comparatively narrow, being only a few miles in depth to the boundary with Netherlands territory; and in this narrow strip of land large quantities of valuable timber have been destroyed by generations of Dyak farming. What there is left should be preserved as far as possible for local use, for were these woods, even the commonest of them, once worked out, the inhabitants of this town and the neighborhood would be put to the greatest inconvenience.

"His Highness now proposed that all woods in the forests lying between Tanjong Datu and the right bank of the Sadong River shall be preserved for the use of the inhabitants, and that after six months from the present date the exportation of timber from any port within the above-mentioned limits shall be prohibited.

"This was carried unanimously."

Tonto Storage Reservoir will be Built.

The second great step in the reclamation of the Salt River Valley of Arizona, under the provision of the National Irrigation Act, has been taken with the closing of the subscription books of those who will take stock as water users under the association formed to deal with the government. The first step was the formation of the Salt River Valley Water Users' Association, to subscribe for the 180,000 acres of land which government experts have calculated can be irrigated from the proposed works. There were 195,000 acres subscribed in tracts not exceeding 160 acres, and each acre represents a share of stock in the association. The next step will be the drawing up of the contract between the federal government and the organization which represents the irrigators and stockholders.

With the liens on all land necessary to make the venture a success being assured, the users are united and jubilant over the outcome.

Forest Policy for California.

The State of California, in coöperation with the Bureau of Forestry, has started on a far-reaching investigation of California's forest resources, and the proper policy to conserve and improve them, particularly in connection with the water supply. This study will concern itself with questions of lumbering and reproduction, with forest planting, fire protection, and a general survey to show the range and distribution of all valuable species of California woods. The results of the investigations will be embodied in a report, and the recommendations contained in this report will go a long way toward determining the future forest policy of the state. The state has appropriated \$15,000 for the surveys, which amount will be duplicated by the national government, each party to the investigation contributing dollar for dollar for the work. The agents of the Bureau of Forestry will also make efforts to collect all arguments for and against the creation of forest reserves, and to get the general opinion of the people in each locality.

Irrigation for Indians.

Considerable sympathy and no little paper has been wasted over the eviction of the Warner's Ranch Indians of southern California from their hereditary home to the Pala Valley, where the government has obtained for them an allotment of land. It is only necessary to state one or two of the material differences brought about by the new conditions to show how immeasurably better off the Indians now are than they have been heretofore, with the possible exception of the time when they were under the mission *padres*. Their former holding was 900 acres, with insecure title, and a continuous stream of outsiders, who visited the hot springs near which the Indians had their homes. The influence of these visitors was harmful. Now they have undisputed title to about 3,500 acres of the best land in California, in a sequestered valley, where there are already many fertile farms and some fine timber. In the matter of irrigation they are par-

ticularly fortunate. There are now 140 miners' inches of water available, instead of the 19 they had for irrigation at their former home, and an official of the Interior Department is at present laying out a modern irrigation system, with cement ditches and a diverting dam, which will at least double the present water supply.

German Comment on Our Methods.

The party of German agriculturists which recently made a tour in this country to study conditions in their relation to German farming made some interesting comments on our institutions. Some of the members praised the work of irrigation, and in Colorado they found some things to their liking in general farming methods. On the whole, however, they were not impressed with the fact that the tour would do anything to improve their agricultural methods. Americans, said they, are exploiting the soil too fast and with little reference to proper crops or the future of the soil itself. This carelessness of the future was also noted in connection with the forests. One of the party said:

"Americans are doing away with wood in their big forests entirely without thought of the future. In the West we found big piles of wood decaying and not used, because it has been cut down without necessity. So long as the American makes money today he does not think of tomorrow. Within ten years they will have to be importing their building wood from Germany, for our forests will never give out: the cutting is regulated by the government."

While one cannot altogether agree with the conclusions expressed by the visitors, it is nevertheless admissible that they have diagnosed American tendencies.

Mexico Must Irrigate.

The British consul at the City of Mexico, says, in a recent report concerning agriculture in that country: "It is an undeniable fact among economists that the territory of the

Republic in its present condition is not capable of producing sufficient to sustain its population; this is daily becoming more serious as the population increases and the agricultural producing power of the country diminishes. The remedy would be irrigation; but this is costly, and unless the government undertake it, private initiative will accomplish little."

A program of national irrigation might easily be carried out in Mexico, as many conditions of soil, water, and climate are ideal, and the benefits to follow would be of surpassing value.

Forestry at West Point. The senior class of the Yale Forest School, acting as agents of the Bureau of Forestry, recently made a plan for the management of the government reservation in connection with the U. S. Military Academy at West Point. Much of the area of this tract is wooded, and the plan is a silvicultural one, involving particular local treatment for each unit of the area. To gain this result the entire tract of 2,300 acres was divided into three ranges, and these ranges subdivided into compartments and subcompartments. Sample plots were taken

in each subcompartment, and the stem analyses made of the arithmetical mean sample tree of each species in the sample plot. The trees which are to be cut are marked on this plot, and will serve as an example in marking the rest of the subcompartment and in future operations. Maps were made showing all of these artificial divisions and the silvicultural types, as well as roads, trails, and topographic features. Those roads and trails which are to be kept free for fire lanes are also designated on the maps. These lanes and a mounted patrol detailed from among the government troopers constitute the plan for fire protection, which will entail no extra cost.

T. S. Woolsey, a graduate of the Yale School, has been appointed forester of the reservation, and while the tract is not large, the plan for improvements contemplates the expenditure of \$6,000,000, which gives the position a greater importance than the size of the tract might indicate.

The photograph which accompanies this account was furnished by Roy L. Marston, who, as field assistant of the Bureau of Forestry, had charge of the party which made the preliminary investigations.



YALE FOREST SCHOOL SENIORS AND AGENTS OF THE BUREAU OF FORESTRY ON THE GOVERNMENT RESERVATION AT WEST POINT.

Valuable Library for Stanford.

Stanford University, at Palo Alto, California, has secured the civil engineering library of the late J. W. F. Conrad, chief director of water works and waterways in Holland. This collection is considered one of the best in its particular branch of engineering and consists of more than 1,700 bound volumes and a great number of pamphlets, some of the publications dating as far back as 1590. The library contains all of the works of the late director Conrad, and of his father, who was also one of the foremost Dutch civil engineers of his time. Another part of the collection comprises a great number of maps, charts, and photographs of dikes, ditches, and canals in Holland. Most of the books are in Dutch and some are in French; they are authoritative treatises on river flow, floods, dikes, canals, steam and wind mills for pumping, drainage, dredging, and all manner of public hydrographic works connected with Holland and the Dutch East Indies.

Stanford contemplates an immediate enlarging of the facilities of her engineering courses, and buildings are now being completed to adequately house the new departments contemplated. Irrigation engineering, especially as it pertains to California, will have no small part in the curriculum, and in a recently published article by Dr. Jordan, president of the university, he promises, in addition to general engineering and agricultural courses, one in forestry as well.

Government Timber Suits.

The United States government has brought suit for \$2,000,000 in the federal court at Butte, Montana, and seeks to recover that amount as damages from the Anaconda Copper Company, Bitter Root Development Company, Marcus Daly estate, William Scallon and others, who are alleged to have been guilty of cutting timber to that value from the public domain in the western part of Montana. It is said that the suits will be pressed in bearing out the present policy of the government to protect all timber lands. The

strip of territory denuded is from one to five miles wide and from 50 to 75 miles long, extending along the valley of the Bitter Root River. The defendants are said to have sought immunity from prosecution by organizing and reorganizing under different names in an effort to conceal their identity. Previous to 1900 timber on mineral lands might be cut and sold, but the rules have been changed so that the timber may be cut for use in developing mines, the private property of the cutter, but cannot be made into lumber and sold.

Eucalypts for Fuel.

Californians are devoting considerable attention to the growing of Eucalyptus trees for fuel purposes. The remarkably rapid growth makes certain species especially adapted for fire-wood. Their advantages are, besides maturing quickly, ability to thrive in thick stands and to reproduce abundant timber in coppice growth. Near El Toro, California, 3,600 acres will be planted with this exotic, for fuel purposes alone. Experiments demonstrate that under favorable conditions 20 tons of dry wood a year may be perennially cut from well-managed groves at a cost much less than that of coal.

Irrigation and the Land Laws.

The Russian government contemplates undertaking large irrigation works in Western Siberia. Nearly eleven hundred artesian wells have been bored in two districts during the last five years, at a cost of nearly \$400,000. The government has also constructed over three hundred miles of canals and has dredged and utilized a hundred additional miles of river beds for irrigation.

Most foreign countries of prominence have undertaken in one form or another government irrigation or aid thereto, and the United States is charged with being somewhat tardy in this respect. Nowhere in the world, however, are the possibilities as great as they are in this country. We have vast areas of arid but fertile land and an enormous aggregate of water supply now running to

waste, but which can be saved and made to reclaim this land. Congress has decreed that government irrigation shall become a fact. If that body will now give its attention to our land laws and repeal those measures under which the remaining public lands, which should be reserved for the use of actual settlers in small tracts, are being acquired by speculators and live stock interests, in many cases fraudulently, it will not be long before Arid America will begin to build up into a prosperous and thriving agricultural section.

**Eastern Press
Favors
National
Irrigation.**

A matter for general congratulation is the broad national attitude which the Eastern press has assumed in treating the irrigation problem since the subject was brought prominently before the country by its discussion in Congress, followed by the passage of the National Irrigation Act. With hardly an exception the great dailies, the magazines, and the small papers from Omaha to Cape Cod have cordially commended the national irrigation proposition from every standpoint, and have pointed out the great good which would accrue to the nation through its practical application, at the same time showing that the federal government is the logical and only agent which can most successfully put into operation a plan of general land reclamation.

**Prospects of
the Uncom-
pahgre
Project.**

The three of the five national projects under the new irrigation law which have progressed farthest are those of the Salt River Valley, in Arizona; the Uncompahgre Valley, in Colorado, and the Truckee River project, in Nevada. Of these, the Tonto or Salt River Valley reservoir has made a further advance in some ways than the others, all shares of stock in the Salt River Valley Water Users' Association having been signed for. The Uncompahgre project is practically as far advanced, and the venture seems assured, for there have been

enough takers of stock in the water users' association, founded on the same lines as the Arizona organization, to make the completion of the work practically a foregone conclusion. At the present time, Hydrographer Newell, of the U. S. Geological Survey, has a party in the field mapping out the proposed works, which will include a reservoir and a tunnel from the Gunnison River to give its needed water to the Uncompahgre Valley. The actual irrigable area is also being determined, and, with that assured, much future trouble will be obviated. There are a few questions of land titles to be settled yet, but it is expected that they will be adjusted by the end of the present summer, and the actual plans for the tunnel and distributing canal can then be perfected.

**Forestry at
Berea College.**

Berea College, Berea, Kentucky, is another of the higher institutions of learning of the country that offers practical courses in forestry. It makes the announcement of a year's course in forest work, which can be taken in connection with collateral branches to be elected from the regular college course. The college estate includes a forest reserve of about 3,000 acres, containing a large number of tree species growing under varied conditions. Full information concerning courses to be given this fall may be obtained by addressing S. C. Mason, Professor of Horticulture and Forestry, Berea College, Berea, Kentucky.

**Railroads and
Forestry.**

Railroad companies in this and other countries have been taking up questions of forestry and forest economy, particularly as they affect their interests in the matter of the great consumption of cross-ties used in road-bed construction. In the United States the Bureau of Forestry has coöperated with the roads, particularly in that phase of forest economy which pertains to the preservation of ties and railway timbers. Dr. Herman von Schrenk, chief

of the Division of Forest Products, has paid particular attention to the proper seasoning and preserving of cheaper timber to be used instead of expensive high-grade material heretofore employed until its growing scarcity and higher prices made it almost prohibitive. It has been demonstrated that with proper seasoning and the infusion of preservative fluids, such as creosote, the low-grade woods may be made to last longer than the untreated high-grade lumber. In fact, it is claimed that the more porous woods are more easily penetrated by the preserving matter and retain it longer in their more porous structure, so that they have an actual advantage over hard oak. It is a fact that inferior woods are continuing to replace the better kinds in railroad construction, and when they are properly treated they may replace them to advantage. Moreover, the railroads are investing in lands where they may grow their own ties and thus not have to depend on poor material when they need a rush order and are at the mercy of the dealer. Many of them have shops for the building and repair of their rolling stock, and it would effect a considerable saving if they had their own timber for supplies. Heretofore the forest areas in the land grants to railways were sold as soon as possible; but there is a growing tendency now to hold these lands not only for the increase in value which is sure to follow, but for the forest operations of the railroad themselves. Even where forests do not already exist, some western roads are setting out trees along the right of way, to serve the double purpose of drift fences and snow-breaks and to furnish ties and other lumber.

Among the various methods suggested to economize in ties is one to cut them in triangular cross-section instead of square, as at present, and thus make a considerable saving in material. A Danish authority has tried hardwood plugs or dowels at the places where the spikes are to be driven, and claims several advantages: The spike holds to better advantage than it would otherwise, and does not slip sideways in the tie. Without the dowels it is found that in shift-

ing spikes a new hole has to be made each time, and this increases the liability to decay at the point where it is most apt to occur and where it is most disadvantageous. With the dowels, heavily creosoted, the preserving fluid is forced into the wood of the tie, increasing its resistance to decay; also the dowels support the base of the rail or tie-plate, and get so compressed and hard that they can stand for many years the impact of the rail. The use of hard plugs in softer wood ties effects a great economy in construction.

National Irrigation Congress.

The Eleventh National Irrigation Congress will be held at Ogden, Utah, September 15 to 17.

For the first time in the program of irrigation congresses, a liberal state appropriation has been made available, and the present meeting promises to be more interesting and more largely attended than any previous one. The program will include discussions and addresses on practical irrigation and forestry lessons, reports of experts, application of provisions of the reclamation act, state progress under the national irrigation act, views on the settlement of legal questions, and the general theme of colonization through reclamation. The president of the congress, Senator W. A. Clark, of Montana, will preside at the meetings.

The Union Pacific Railway has arranged for a special excursion of Washington newspaper correspondents, and a train carrying the representatives of the leading papers of the country will leave Washington September 7, the itinerary, both going and returning, to include visits to a number of irrigation enterprises. Such a trip should result in a valuable series of articles on irrigation works and a consequent widespread interest in the subject of western reclamation.

Forest Extension in Massachusetts.

The Massachusetts Forestry Association has employed a forester for the coming year. Theo.

F. Borst, a graduate of the Cornell

School of Forestry, has been chosen for this position. An arrangement has been made whereby Mr. Borst will give half his time to work for the Bureau of Forestry and receive an appointment from the bureau as agent. It is hoped that this sort of coöperation will bring the work of the various Massachusetts state associations into closer relations with each other and with the Bureau of Forestry.

During the past year Mr. Borst has creditably filled the position of forester for the Metropolitan Water and Sewerage Board, which has under its charge the reservoirs that supply the city of Boston with water. He has assisted in the execution of a planting plan made by the Bureau of Forestry two years ago, for the reforestation of the 3,000 acres of watershed adjacent to the reservoirs.

Very important work is planned for the coming year in Massachusetts. A planting plan will be made for the Mount Wachusett State Reservation of about 1,400 acres. The fire warden service will be called together early this fall and organized on a thoroughly efficient basis. Meetings of granges and other organizations will be visited by the Bureau's agent, and personal instruction and assistance will be given to the various parties now executing planting plans in coöperation with the Bureau of Forestry.

Irrigation Exhibit at the World's Fair.

There will be an irrigation demonstration prepared by the government for exhibit at the St. Louis Exposition which will consist of at least three models. One of these will reproduce in miniature the Tonto storage dam, another will include a section of the box canyon below the dam, and the third, showing a typical irrigated area, will be a close reproduction of Mesa City, Ariz., on a scale of about 20 inches to the mile. This model will show houses, farms, orchards, and the canals and ditches with their headgates and power works. Mesa City is an ideal irrigation community. It was originally settled by thrifty Mormons, who took small holdings and made the utmost use

of every acre. As the name indicates, the place is situated on a fertile tableland, and is about 18 miles east of Phoenix, Ariz. The preparation of these models will be under the direct supervision of the Geological Survey, and an agent of the Survey is at present in the Salt River Valley gathering data from which the details of the construction will be made. It is expected that this exhibit will have not only a unique interest for the people of the eastern United States, but that it will still further convert them to a realization of the value of western irrigation in the development of the whole country.

To Have Charge of California's Exhibit.

W. H. Mills has been appointed chief of the department of forestry for the California exhibit at the St. Louis Exposition. He has had experience in the land office of the Southern Pacific Railway and has been a student of forestry for some time. He has also a good acquaintance with lumbermen and foresters throughout California, and it is believed that he can get the best specimens of the state's forest products and at slight expense to the California department. He was appointed by the commissioners of California for the Louisiana Purchase Exposition.

Forest Management in New Hampshire.

Heirs of the late Austin Corbin, of New York, have decided to practice forestry on the Blue Mountain Forest Park, near Newport, in Sullivan county, New Hampshire. Alfred Akerman, an instructor in the Yale Forest School, with eight men, will be employed on the work during the summer. The Blue Mountain Forest Park is one of the noted game preserves of the country. It contains 25,000 acres, and is stocked with a variety of wild animals, containing what is said to be the largest herd of pure-bred buffalo in this country,—128 head. Besides buffalo, the park contains wild boar from Germany, elk, moose, and deer of several kinds. The

owners of the park wish it to be maintained first of all as a game preserve; but they are also anxious that the timber be put in the best condition possible, and for that reason have decided to manage it according to principles of forestry. The park was established twelve years ago by the late Austin Corbin, who fenced it and stocked it with game. The long ridge of Croydon Mountain runs through the tract, and in this ridge grows a forest composed of Spruce and hardwoods. The Spruce is now being lumbered under forest management. Old pastures in the tract, which are growing up to Spruce, will be studied by Mr. Akerman and his party in order to devise ways of hastening the reproduction.

Another piece of forestry work in New Hampshire which will be undertaken by the Bureau of Forestry this summer is a working plan for the management of 3,000 acres of cut-over land on the southwest slope of Mt. Moosilauke, in Grafton county, owned by the Pike Manufacturing Company. The favorable market conditions there offer an opportunity to show what forestry can accomplish on land from which the large Spruce and other softwoods have been removed. This work will be in charge of T. S. Woolsey, a recent graduate of the Yale Forest School.

Geological Survey's Maps Endorsed.

Mr. Arnold Becker, manager for Becker & Co., lumbermen, of Seattle, Wash., in a letter to Mr. Charles D. Walcott, Director of the U. S. Geological Survey, gives a strong endorsement to the accuracy of the maps published by the Survey, the endorsement being based on a careful investigation. The Becker Company made a thorough examination of a tract of timber, amounting to more than 1,000,000,000 feet, lying within the territory covered by the Coos Bay quadrangle of the Geological Survey's map of Washington. The tract was very carefully gone over by timber cruisers, twenty-four men having been engaged in the work during a period of three months. The

cruise was made by 40-acre tracts, and cost the company more than \$10,000. Checking up the results of the cruise by the estimates of standing timber given on the Survey's map, the result for the entire tract differed by less than 9,000,000 feet out of the 1,000,000,000 between the particularly careful cruise and the estimate of the Geological Survey. The estimates of the Survey map were arrived at as follows: Where a shaded area was said to represent from 15,000 to 25,000 feet per acre, the timber was estimated at 20,000 feet where represented by that particular shade, and so on. A multiplication of this average by the number of acres gave the Survey's estimate, with the result mentioned above.

This is a striking demonstration of the accuracy of the work of the Geological Survey.

Professor Mead Goes Abroad.

Professor Elwood Mead, in charge of irrigation investigations for the U. S. Department of Agriculture, has left this country for a trip in southern Europe. While there he will investigate irrigation institutions, paying particular attention to those in Italy; and in Italy the works in the Po Valley will receive especial study, as they approximate some in this country. It is understood that Professor Mead will be gone about three months.

A Long Water Transmission.

Australia claims a record piping of water, the distance being 350 miles. A large dam, the Mundaring weir, which is 90 feet high and impounds 5,000,000,000 gallons of water, has been constructed across the Helena River near Perth, and water is pumped from the reservoir formed through steel mains at the rate of 6,000,000 gallons per day. There are a number of auxiliary reservoirs and pumping stations along the line, which runs parallel with the railroad into the Kalgoorlie mining district, reputed to be the "richest square mile of earth on the globe." This district lies in the extremely arid interior of Australia,

where there is no water to be had, and the wealth of the mines makes such a stupendous venture a paying one. The water is not used for irrigation, but for general purposes in the mining town. The engineering feat involved is noted because of its possible bearing on the question of long-distance transmission of water.

To Lengthen the Life of Timbers.

The American Telegraph and Telephone Company is experimenting this summer

with methods of lengthening the lasting powers of cedar and chestnut poles. The Bureau of Forestry has sent several men to Wilmington, N. C., to study the loss of weight by cedar poles under proper methods of seasoning, and the increased length of service of the poles which seasoning and preserving brings about. Similar work is being carried on near Harrisburg, Pa., with chestnut poles. In Bear Canyon, Gallatin county, Montana, and at Sheridan, Wyoming, the seasoning tests with Lodgepole Pine begun last summer in coöperation with the Burlington Railroad will be continued. Experiments in seasoning and preserving Longleaf Pine ties will be carried on on a large scale at Silsbee, Texas, on the tract of the Kirby Lumber Co. All this work will be under the general supervision of Dr. Hermann von Schrenk, new chief of the Division of Forest Products, Bureau of Forestry.

Lectures on Forestry in California.

The University of California has inaugurated a summer lecture course in forestry, the sessions to be held at Idyllwild, San Jacinto Mountains, Riverside county, California. The undertaking is under the auspices of the College of Agriculture of the University, and the course will include at least twenty lectures, with accompanying field-work in the form of excursions into the forests of the San Jacinto Mountains. The principal object of the lectures is stated to be a correction of the sentimental view of forestry prevalent in the popular mind,

in order to bring out a better understanding of the underlying economic principles.

Dr. Willis L. Jepson, professor of botany, and Prof. Arnold V. Steubenrach, professor of agriculture, will have charge of the work. The fee will be six dollars for the entire course, said fee to go to the University of California to assist in defraying expenses.

Idyllwild is ideally situated for such a course of lectures, as the surroundings are beautiful and full of interest. There are many unique natural features, which, with the fact that the nearby forest contains the greatest variety of trees in California, recommend it as an excellent situation.

New National Irrigation Projects.

In addition to the several irrigation projects already undertaken by the federal government, and to which attention has been called in FORESTRY AND IRRIGATION from time to time, preliminary steps have just been taken looking to the development of a number of others. Public lands have been withdrawn from entry in certain sections in a number of states, pending further examination by the government reclamation service to determine the feasibility of the projects named.

In south central Idaho 30 townships have been withdrawn for the Snake River project, these being in addition to 30 townships in the original segregation in the vicinity of Mud Lake, on the north fork of the Snake River. In addition, the reservoir sites known as Lake Henry, Flat Rock, and Island Park have also been reserved. Just across the boundary in Wyoming, in the Yellowstone Forest Reserve, Jackson Lake, Two Ocean Lake, Emma Matilda, and Jenny Lake have been reserved for reservoir sites, all in connection with the above-mentioned project. Investigations are being carried on in the vicinity of the Black Hills, and a body of public land consisting of 31 townships, just east of the Hills region and on the south fork of the Cheyenne River, involving a number of small res-

ervoir sites, has been withdrawn from entry. Eighteen townships of these, along what is known as the Belle Fourche, a tributary of the south fork of the Cheyenne, have also been withdrawn. In the central part of Washington a tract of 100 townships of public land has been withdrawn in connection with the Big Bend project; seven townships have been withdrawn on the Okanogan River and 7 townships near Lake Chelan. Still another withdrawal of 20 townships has been made in eastern Oregon, in the vicinity of Malheur Lake, and in connection with this a large reservoir site on Silvies River has been withdrawn. On the Malheur River a large reservoir site and 18 townships have been withdrawn. In Arizona 16 additional townships have been reserved in connection with the Salt River project. A large tract withdrawn from settlement last year near Sterling, Colorado, has been restored to entry, owing to the fact that a closer examination showed that the water supply was not sufficient for the proposed project.

Flood on the Colorado.

The annual rise in the Colorado River was later and much higher than usual this year, the flood conditions resulting in some damage along its course. The first serious rise was noted about June 25, although government reports had warned ranchers of the impending flood, and the precautions that were taken resulted in minimizing the danger. The water was subsiding on July 12 and all danger was past. Mr. J. B. Lippincott, resident hydrographer for the U. S. Geological Survey, made an investigation of the flood conditions. He points out that the high water was due to a later and more rapid melting of snow at the headwaters in the mountains of Montana, Wyoming, and Colorado, the flood water, which damaged property only below Yuma, having traveled some 2,000 miles. There were no additions to the water in the last 150 miles it traveled. There was some damage to the irrigation works of the Imperial company at Imperial, California. Below Yuma the river is 10 miles wide

in some places and 50,000 acres of bottom land is covered, inflicting great damage on growing crops. This inundation calls renewed attention to the likeness which exists between the Colorado and the Nile, and points to similar restraining and storing works for use on "the American Nile."

To Hold Sand Dunes.

In order to determine whether the sand dunes on government land in central Minnesota are of sufficient extent to render the land unfit for agriculture and adapted for a forest reserve, the Bureau of Forestry will send out a party this summer under H. B. Kempton to study the matter. Mr. Kempton will also try to devise methods by which the farmer in the sand-dune regions will be able to protect his land. A similar study will be made under Mr. Kempton in Michigan, along the shores of Lake Michigan. This work was begun last year on the Atlantic Coast and in the Columbia River country of the Northwest, and resulted in the discovery of valuable methods in restraining drifting sands.

Assuan Dam a Success

The Nile Reservoir dam at Assuan, of which a full account was given in the December, 1902, issue of FORESTRY AND IRRIGATION, was emptied of its stored waters on July 6. The principle of the dam is that of holding the water during high Nile and gradually letting it out through sluices during the time of low water, to run in the channel of the stream to supply irrigation canals with a constant flow in the growing season. It was not intended to develop new irrigation works or supply a larger system of canals than were in use before the dam was built, but to render sure all crops under the present system by providing an unfailing water supply. In other words, it is planned to extend the area of perennially irrigated land, on which two or three crops can be grown each year, at the expense of the basin land on which only one crop is possible. Press reports say that the area in cotton has been in-

creased this year under irrigation from the dam, and the success of the summer crops is assured in the entire tributary area. Officials say that the expenditure on the dam, nearly \$10,000,000, seems fully justified by the results obtained and promised for the future.

The Relations of Forestry to Zoology.

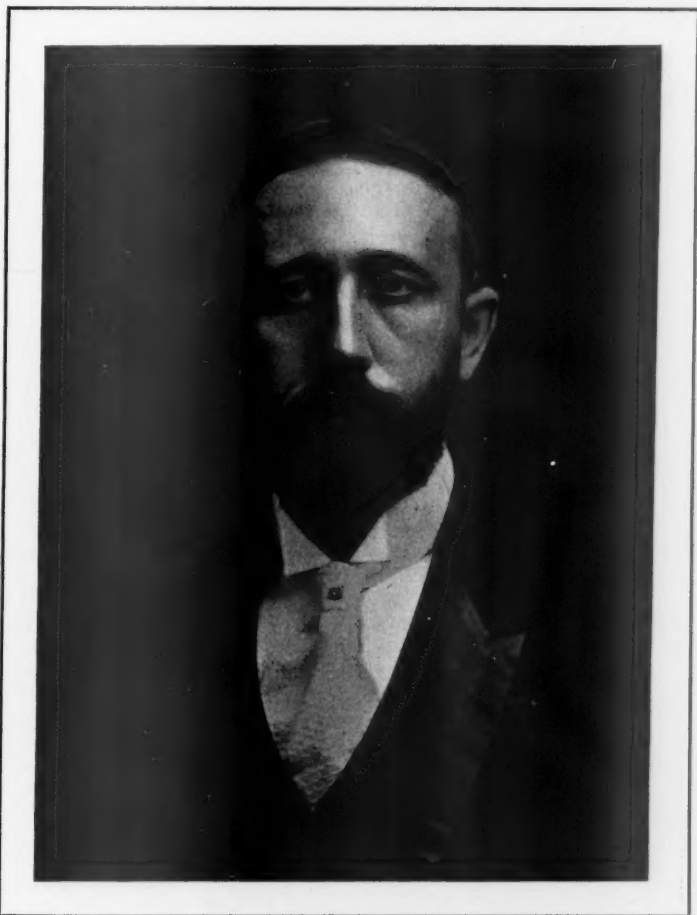
It has been pointed out recently by H. A. Surface, professor of Zoölogy at Pennsylvania State College, that there is a direct and important connection between forestry and zoölogy, and he gives several examples of how this connection exists. Aside from the clearing of forest growths which naturally drives the denizens of the woods from the cleared localities, he finds that the effect of forest destruction on streams is a far-reaching one. Clear streams, flowing perpetually through wooded country, are the natural haunt of the trout; but if the country in which these streams rise or have their courses is destructively cut over, the streams themselves become intermittent, muddy, and in some cases only a succession of warm and slime-covered pools in midsummer. As such they are fit only for the lurking places of the mud-sucker and the carp. In the larger streams and rivers which, under natural conditions, are the homes of the desirable game fishes, the black bass and pickerel, which pass the winter in deep pools in a state of partial hibernation or quietude, the changes are even more to be deplored when the watershed is deforested. Floods arising from the destruction of the trees bring down immense quantities of silt, "washings," sand, etc., and deposit them in the deep pools, where the current runs slower, so that the quiescent fish are covered over and destroyed. Another disastrous result comes from the washing of the fishes out of their places of winter abode, dashing them against rocks and ice and in some cases leaving them stranded to gasp out their lives after the water subsides.

The setting aside of forest reserves will not only keep the forest and the beauty of the landscape, but will restore

game and song birds to their original haunts, protect the wild animals, and preserve the most desirable fishes—the trout, bass, and pickerel.

Alkali Land Reclamation.

Mr. Thomas H. Means, in charge of the Soils Surveys of the United States, for the Bureau of Soils, Department of Agriculture, is spending the present summer in dealing with alkali conditions in several of the western states. He is the recognized authority on alkali problems in the country, and his present work is really outside the realm of mere investigation, being more in the nature of a practical demonstration of results that may be obtained from the adoption of proper measures. Already there have been established stations at Salt Lake City, Utah, and at Fresno, California. These have proved that reclamation is feasible. Mr. Means has just completed the installation of a station at North Yakima, Washington, and is at present visiting the station at Fresno, as a first step in a tour of the different localities where the work has been or may be carried on. At Billings, Montana, a demonstration of the value of reclamation is also to be made, and as there are quantities of alkali in the neighborhood, the work there will have great value. At North Yakima there are some 3,000 acres of alkali land whose reclamation has already been proved possible at a cost not to exceed \$20 an acre. As the alkali land is worthless in its present state, and is worth \$150 reclaimed, the usefulness of such an illustration is readily understood. There are about 4,000,000 acres of alkali land in the West now lying idle, and as it is the best bottom land, its reclamation will be worth a great deal. The Bureau of Soils does not anticipate taking charge of this reclamation, nor recommending any government action concerning the lands. The object of the present operations is to make the practicability and value of the simple drainage systems used so patent to the farmer that he will be anxious to undertake the work for the advantage that will accrue to him.



WILLIAM ELLSWORTH SMYTHE,

AUTHOR OF "THE CONQUEST OF ARID AMERICA."

MR. WILLIAM E. SMYTHE is recognized as one of the pioneers in the national irrigation movement, having for a long time given his aid in a variety of ways to furthering the cause of the reclamation of the arid lands of the West. His principal work in this regard has been journalistic; he has written books and articles which have called the attention of the country to the work that was being done, and the need for still further efforts. But in addition to this he has done much of a practical nature, in the way of organizing irrigation associations, delivering addresses in favor of the irrigation movement, and founding colonies to develop and be developed through the application of water to arid country.

Mr Smythe was born at Worcester, Mass., December 24, 1861, and has engaged in journalistic work since 1880. In 1890 he held an editorial position on the *Omaha Bee*, and in the following year initiated the movement which resulted in the National Irrigation Congress, of which he later became secretary and then chairman. In 1891 he established the *Irrigation Age*, which he edited for five years, giving it up for broader journalistic ventures, which bore fruit in authoritative articles in the leading periodicals of the country. In 1895 he undertook the organization of the New Plymouth Colony in the Payette Valley of Idaho, a venture which proved an economic and sociologic success. At present Mr. Smythe has his residence in San Diego, California. In addition to his present literary work, he is president of the Constructive League of California, whose aim is to upbuild the state, and whose present efforts are directed along the lines of public irrigation works, coöperation among producers, and the reform of the land laws.

THE UNALASKA SPRUCE PLANTATION.

TREES ONE HUNDRED YEARS OLD TELL OF
AN ATTEMPT AT FORESTATION ON THE ALEU-
TIAN ISLANDS, WHERE TIMBER IS WANTING.

BY

BRISTOW ADAMS.

ATTENTION has been recently directed to the chain of Aleutian Islands from a number of sources. Our growing trans-Pacific trade has given them a new importance, as they lie only a few miles to the north of the route in "great circle" navigation, and the possibility of a port for steamers to touch for supplies is not a remote one. Already the United States Government has agencies at Unalaska and Dutch Harbor and a coaling station at the latter point. These two stations are on Unalaska Island, within a mile of each

other, across a slight rise between different arms of the same fiord. Alaskan trade has carried many vessels through Akutan Pass near this island, and such vessels generally touch at one or the other of these harbors for coal and water. Economic as well as commercial considerations point to a growing importance for the whole chain of islands, and it is perhaps not too much to predict that there is yet a possibility that the fox and fur seal industries may be commercially developed in Bering Sea without extinction of the animals, thus aiding in

the development of this northern country. Already there has been a successful grazing enterprise started on some of the islands; coal is known to exist in certain places, and persons who are familiar with conditions say that the region is yet destined to become one of the great summer resorts of the United States. Thus it can be seen that a number of things point toward a future development, in which timber will be needed.

At present practically all wood, except such drift as natives use, comes from San Francisco at enormous expense. The natives' houses, except where furnished by the trading companies or the Government, are made of sod, sometimes with four great sections of whale ribs at the corners. Their



Photo by G. A. Clark.

YOUNG SITKA SPRUCE ON WOOD ISLAND. BUILDING IN BACK-
GROUND OF IMPORTED LUMBER. FOOTBRIDGE
OF NATIVE WOOD.

boats are made of sea-lion skin over wood or bone frames, and everywhere there is a proclamation of the makeshift for lumber. The coming of the white man, however, is always accompanied by an effort to improve conditions, to import materials to change them to his standard of life, rather than an attempt to make the individual fit into the surroundings.

General conditions on these islands are peculiar. The Alentian chain is of recent geologic formation, volcanic in origin, and some of the islands today contain active craters. Their general characteristic as a chain of mountains partly submerged gives them a ragged contour, and most of them rise to considerable heights from the sea. Nevertheless there are many gentle slopes and some small alluvial valleys where forests might be expected to grow. There is plenty of moisture, and the cold is not excessive. Various explanations have been advanced as to why they are absolutely treeless, but none of these explain. Henry Gannett, Geographer of the Geological Survey, wonders why Kadiak Island and the peninsula and islands west of it are not wooded, adding that "the rainfall is ample, the climate little more severe than at Sitka, less severe than about Prince William Sound. The suggestion that high cold winds prevent tree growth is negated by the fact that such winds occur all along the coast in forested as well as non-forested parts." Dr. Fernow seeks to make a plausible explanation by taking into consideration the rôle the winds play and says that a forest could come only from the east and northeast and only under the condition of prevailing winds from those quarters during the months that Spruce and Hemlock seeds are released. During this period winds are generally from the opposite directions. So far this explanation is a good one, but it does not tell just why Afog-



From Pencil Sketch by Author.

NATIVE'S HOUSE ON WOOD ISLAND MADE OF ISLAND GROWN LUMBER.

nak where there is a United States forest reserve, and Wood and Spruce Islands are forested, nor why a geometric line drawn through Kadiak will find wooded areas on one side and treeless on another. East of Kadiak there is some measure of sun during the summer, but west of it ten glimpses constitute a remarkable season; but that should have no influence on Sitka Spruce, which has no partiality for sunlight. It may be, as Dr. Fernow suggests, that there is a difference in temperature and moisture between winds that come from the Pacific Ocean direct or across the Gulf of Alaska, but in the absence of careful study this cannot be taken into account, though a personal estimate would say that the balance was really in favor of the more western winds.



Photo by C. H. Roesch.

DUTCH HARBOR AND UNALASKA. PIER OF DUTCH HARBOR POINTS INLAND TO SMALL
POND WITH PLANTED TREES NEAR IT.



Photo by C. H. Roesch.

THE PLANTATION OF SITKA SPRUCE NEAR UNALASKA.

Other vegetation on the islands is rank; grasses and wild grains grow with fabulous luxuriance to remarkable heights, and some vegetables may be raised. Even on the Pribilof Islands, some 200 miles to the north, the ground is matted with the creeping Arctic willow and glorious with yellow poppies and blue lupine; turnips and quick-maturing vegetables can be grown, and from the presence of white men there, almost from their discovery, it would seem that some attempt might have been made toward having a tree or two for the sake of mere company.

Whatever may have been the prompting motive, however, it is nevertheless a fact that a tree-planting experiment was made on the Aleutian Islands as far back as 1805, and the evidence of that planting is there today. At that time Unalaska was a trading post and a mission station of the Russians. A priest of the Russian-Greek Church made a plantation of Sitka Spruce in a sheltered cove among the hills back of what is now Dutch Harbor. How many trees were originally planted is not known, but at the present time there are six or eight alive, dwarfed and knotted, but still unmistakably trees, and a proof that they can at least live farther west than Kadiak Island. What these trees might have done if they could have had the benefit of a little care and cultivation is a surmise, yet it is likely that they have done as well as they could under any conditions.

The largest is about 25 feet high, or perhaps a little less, and the growth of all is unusually compact, like that of the ornamental Norway Spruce planted on open lawns, only more so. Their branches form a perfect mat, and a bird shot in the top of one would not fall to the ground. This was actually proved by members of the Harriman Expedition. None of the trees have ever been cut, so far as known, and there has been no reproduction. When seen by the writer there were no cones in evidence, though the cones of the Sitka Spruce at the extreme western limit of their range, on Kadiak, seem to be larger than those on the bigger trees of the mainland, where the species grows to its highest perfection.

Even here in fog and mist, these trees have suffered from the scourge of fire, for on one or two, the lower limbs, which lie close to the ground, have been burned to a man's height, presumably from a blaze in the "wild rye" grass, which has a rank growth in the cove where the plantation is found.

The trees stand today, the record of a century's battle with adverse conditions, 500 miles from their nearest kin, and they do not look as if they liked it. In view of their testimony, it is quite apparent that no matter what the future of the peninsula and islands may be, it does not lie in the direction of forest production, and lumber will have to be imported as heretofore.

ELECTRIC POWER FOR PUMPING

LONG-DISTANCE TRANSMISSION MAKES POSSIBLE
A CHEAP METHOD OF RAISING WATER IN WELLS
AND DOUBLES THE VALUE OF STREAMS FOR IRRIGATION—A SYSTEM PECULIAR TO CALIFORNIA.

BY

GUY ELLIOTT MITCHELL,

EDITOR OF "THE HOME-MAKER."

THE discovery of a method to transmit electrical power long distances has greatly increased the irri-
gation area of the West, and has opened

the opportunity for the creation of thousands of farm homes deemed impossible only a few years ago.

The tremendous drouth which visited

the entire Southwest four or five years ago, and has continued until this year, was apparently a stunning blow to the irrigation development of that section. Rivers and ditches dried up or gave such small flows of water for irrigation that in many cases not ten per cent of the land formerly cultivated could be watered. The farmers and fruit-growers waited one year, and then a second year, hoping for the rains which did not come before they should give up in despair. Then some few adventurous spirits sunk and drove wells through soil as dry as the proverbial bone, and which it had been supposed was as far removed from water as the mountain tops were from the seashore.

The results were astounding. In many cases water was found only a few fathoms beneath the surface, where the scoffers had predicted that it would not be found if the drills went down a thousand feet. Steam-pumping plants were expensive, for fuel was high; but some of the orchards and groves were worth \$500 and \$1,000 an acre, and water was necessary to their continued existence.

Under these conditions, however, it was not profitable to set out new orchards; but fuel oil was discovered, and oil and gasoline engines reduced the cost of pumping. Still this was somewhat expensive and required the attention of engineers. Then cheap electrical transmission made its appearance, and it is now working a revolution over great areas. It was found that electrical power could be extracted from mountain torrents and transmitted to sections fifty or seventy-five miles away for use in automatic pumping from an inexhaustible underflow.

In this connection it is interesting to note the many times which the water of some of the western rivers is used over and over again. First it pours through some rocky gorge and generates an immense electric power. This is transmitted miles away to do its work, pumping water for irrigation, and supplying towns with current for lighting, street railways, etc. The river in the meantime has lost none of its usefulness. It flows on down and out onto the plains and valleys and is diverted to agricult-

ural land until all its water is taken out and it remains a dry bed. When land has been irrigated for a number of years it becomes so well saturated that thereafter much of the water used for irrigation seeps away, so that as one drives down the dry bed of the river it is seen to be no longer dry. The water used for irrigation has drained off into its natural channels and is returning to the river bed, the lowest point. So that ten miles below the last diversion dam there is a respectable river again flowing toward the sea. This water has now been used twice, once for generating electricity and once for moistening the roots of plants; it is now taken out again to irrigate more land. This returning of the water by seepage may occur three or four times, and each time it is used over again for irrigation, and if large additional areas are irrigated by pumping, the river may actually increase in volume.

Not only is electrical power adding large areas to irrigation by bringing up underground water, but it is also used for pumping water from rivers, where it is simpler and cheaper to employ this method than to build large dams.

The great storage works which the government is about to construct will many of them have auxiliary pumping plants operating by the electrical power which will be generated from the dams. Tremendous electrical power will doubtless be developed by some of the stupendous works which the government has in prospect, and the national irrigation act has been construed to mean that this asset should be used for reclaiming additional lands through pumping.

Unquestionably the national irrigation law, carried to its full completion, will produce results beyond the most sanguine conception of even its enthusiastic advocates. It is pregnant with constantly increasing possibilities for upbuilding and internal development. The present generation cannot expect to see the full and entire reclamation of arid America, for no man knows when the limit of the resources of the West shall have been reached. Today there are thousands of acres of rich land susceptible of irrigation which only five

years ago it was not dreamed could be reclaimed. But the work should proceed rapidly; it should receive the support of the people to the end that new homes may be provided for those who

want them and a barren but resourceful section of country be built up into a prosperous and productive part of the nation. No question was ever more national.

THE HONEY LOCUST IN WESTERN KANSAS.

VALUE OF THIS TREE FOR THE UPLANDS OF
THE SEMI-ARID PORTIONS OF THE STATE.

BY

ROYAL S. KELLOGG,

BUREAU OF FORESTRY.

THE Honey Locust (*Gleditsia triacanthos*), which grows naturally in the valleys of eastern Kansas, has proved to be one of the hardiest trees for planting on the uplands of the western part of the state, where conditions attain semi-aridity and the annual rainfall is 20 inches or less. Among the deciduous species it is approached in hardiness in the region by the Russian Mulberry and Osage Orange, but they occasionally freeze back where the

Honey Locust goes through the winter unscathed. In ability to withstand all-around adverse conditions of soil and climate, the Red Cedar is unsurpassed, but the more frequent failures of it in transplanting it, together with the rate of growth, which averages only one-half to one-third of that of the Locust, make it less a favorite with the general public. While borers have caused complete destruction of the Black Locust (*Robinia pseudacacia*) over much of the



FIG. 1.—HABIT OF GROWTH OF HONEY LOCUST WHEN LEFT UNPRUNED.

state and elsewhere, the Honey Locust is free from them, as well as other pests, and is a uniformly healthy tree. For these reasons it has been extensively planted and is well liked wherever found.

Since the value of the wood is less than that of the other species mentioned, the Honey Locust is most useful for hedge, shelter-belt, and ornamental planting. The natural habit of

finely proportioned tree, of medium height, with an excellent trunk and a handsome spreading crown (see Figs. 2 and 3). The large pods are somewhat unsightly and occasionally the clusters of thorns are objectionable, but as a general thing the thorns are not excessive and many trees are almost or wholly free from them. If large thorns form on the trunk, they can be removed at pruning time, and it will ordinarily be smooth and neat in appearance, as shown in the illustrations.

With cultivation, the rate of growth on the uplands where there is no underlying water to draw on ranges from $\frac{1}{2}$ to $\frac{3}{4}$ inch per year in diameter and 1 to 2 feet in height. This will be reduced, of course, if the trees are left to fight for moisture with the all-pervading roots of the prairie sod, and increased if they are set in the lowlands.

Cultivation for several years after setting at least is essential under ordinary western conditions. The best results are secured by cultivating all the ground covered by the plantation, as shown by Fig. 4. Cultivation should be frequent and shallow, thus keeping the weeds down and conserving the moisture by a dust mulch. Too frequently it is the case that the ground is neglected until a mass of weeds 3 or 4 feet high is formed, and then a plow is used not followed by a harrow. Such treatment breaks many roots, leaves the ground rough, and increases the evaporation from the soil, and makes a dead fur-

row between the rows to receive the rainfall that should be evenly distributed if not thrown toward the trees. For frequent cultivation the Acme harrow is a rapid and excellent tool.

If trees and lawn are both desired, a compromise may be effected while the trees are young, in the manner shown in Fig. 5. Here a strip 6 to 10 feet wide is cultivated and grass allowed between the rows. Where trees are



FIG. 2.—HONEY LOCUST AT OSBORNE, KANSAS, SET OUT 22 YEARS AGO; 35 FEET HIGH AND 11 INCHES IN DIAMETER.

growth in the open being rather low with heavy lateral branches (see Fig. 1), a single row will form a good wind-break if left unpruned, while if desired it may be cut down to regular hedge proportions. There is no trouble about sprouts from the roots, unless they are cut in cultivation, and it holds its own well against grass after once thoroughly established.

When trimmed, it develops into a



FIG. 3.—ROW OF HONEY LOCUSTS ALONG STREET, OSBORNE, KANS. AVERAGE HEIGHT, 30 FEET; AVERAGE DIAMETER, 10.6 INCHES; AGE, 30 YEARS.



FIG. 4.—ROW OF HONEY LOCUSTS AT SMITH CENTER, KANSAS. AVERAGE HEIGHT, 23 FEET; AVERAGE DIAMETER, 7 INCHES; AGE, 16 YEARS.



FIG. 5.—STRIP METHOD OF CULTIVATION, HAYS, KANSAS.

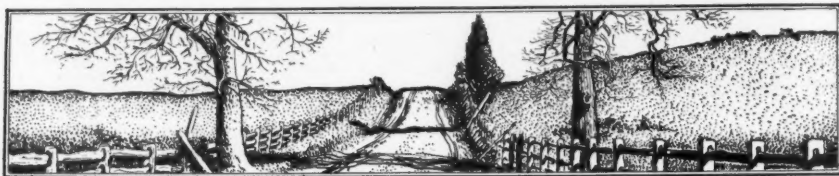
wanted singly in the sod a circular patch around them 8 to 10 feet in diameter may be cultivated by hand. After being well established along streets, the Honey Locust often does excellently without cultivation of any sort, as it is benefited by the accumulation of water in the shallow open gutters after a rain.

The Honey Locust is easily propagated. When only a few large trees are desired quickly, the best method is have them 2 to 4 inches in diameter when set. They should be cut back to 6 or 8 feet high, with a few short laterals to form the basis of the crown. Treated in this way, fine trees can be secured in a few years.

For more extensive planting a cheap and satisfactory method is to sow the seed in gardener's rows one spring and

transplant to the permanent situation the next year. The seed should be scalded before sowing, and may be sown in April or May. With cultivation and ordinary rainfall the seedlings will grow 2 or 3 feet in height during the season and be in shape to handle easily with little pruning when set. The seed is not expensive. There are over 3,000 in a pound, and the per cent of germination is 50 to 75.

Distances in planting are largely a matter of utility and taste. Shelter belts should be closely planted in order to secure a solid windbreak and make shade sufficient to keep down grass and weeds after a few years and render cultivation unnecessary. Trees in rows along streets and yards are usually 15 to 30 feet apart. Those shown in Figs. 3 and 4 are 20 feet.



IRRIGATION IN SAN BERNARDINO VALLEY.

CONDITIONS WHICH HAVE AFFECTED DEVELOPMENT IN A FAMOUS CALIFORNIA FRUIT REGION WHERE WATER PLAYS AN ALL-IMPORTANT PART.

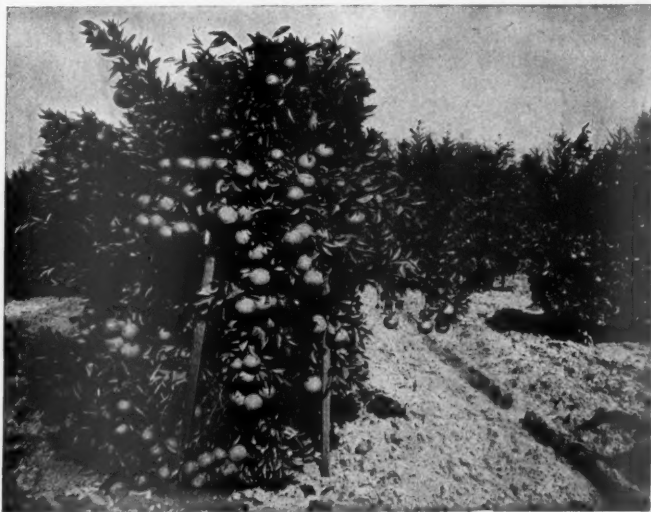
BY

C. A. WENTWORTH.

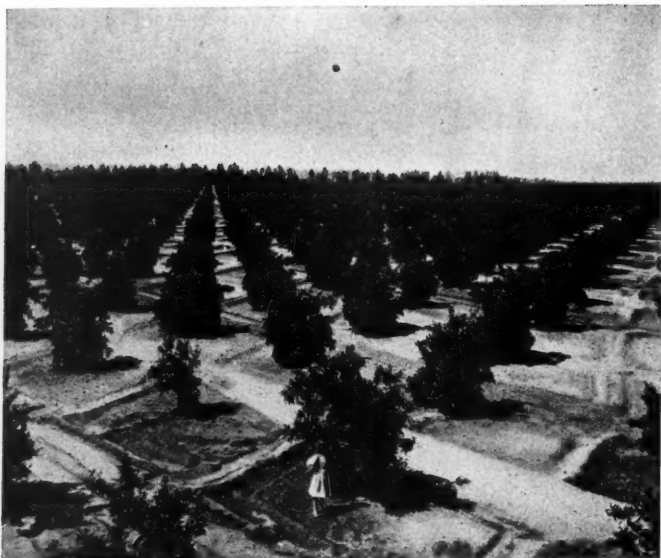
THE agricultural region of California, in which are found the thriving towns of San Bernardino, Redlands, Riverside, Colton, and others, is perhaps the most remarkable in the United States. Its beauty alone, with its surrounding snow-capped mountains, is sufficient to make it noteworthy, but in addition to this the climate is delightful, the soil fertile almost beyond belief, and the crop values fabulous. The environment is ideal, and is the product of progressiveness based on culture and wealth. Indeed, the San Bernardino Valley has been called the Riviera of America.

But without water the region would be a desert, lying, as it does, in a natur-

ally arid country. Thus its principal claim to fame arises from the fact that here water has its greatest value for irrigation of any part of the United States, and the water resources have been developed to the fullest extent. Surface and underground water alike have been dammed, diverted, and drawn upon by tunnels, wells, and pumps. With every known device, the growers of this valley have fought the desert and brought forth a wonderful productivity. Yet in spite of all, the available supply of water barely suffices for areas actually under cultivation, and land which would produce fortunes lies idle and worthless immediately adjoining orchards whose net gains each year



NAVEL ORANGE GROVE AT RIVERSIDE, SAN BERNARDINO VALLEY.



ORANGE GROVE, SHOWING METHOD OF BASIN IRRIGATION.

amount into the hundreds of dollars, and these lands are worthless only so long as the life-giving water is kept from them.

The attention of irrigators all over the world has for a long time been attracted to the development of this valley, and its successes and vicissitudes have had a widespread bearing on the general practice of irrigation. Even now its highest possibilities, its limitations, and the best methods to be pursued are just beginning to be understood, and the present growth of knowledge concerning local conditions is largely due to the tireless investigation of Mr. J. B. Lippincott, who has made the region a subject for specialized study.

The San Bernardino Valley is protected from the cold winds from the inland desert by the San Bernardino Mountains, some of the crests of which are 11,000 feet high, while it is separated from the coastal plain by less lofty ridges. There are a number of streams, of which the Santa Ana River is the largest, whose waters, under present circumstances, are used to their utmost limits.

Not only are the streams drawn upon in their surface flow, wells, pumped and flowing, develop latent water supplies, and dams have been constructed to hold the underground as well as the surface waters. There are a few reservoirs, but extensive ones are precluded on account of the topography.

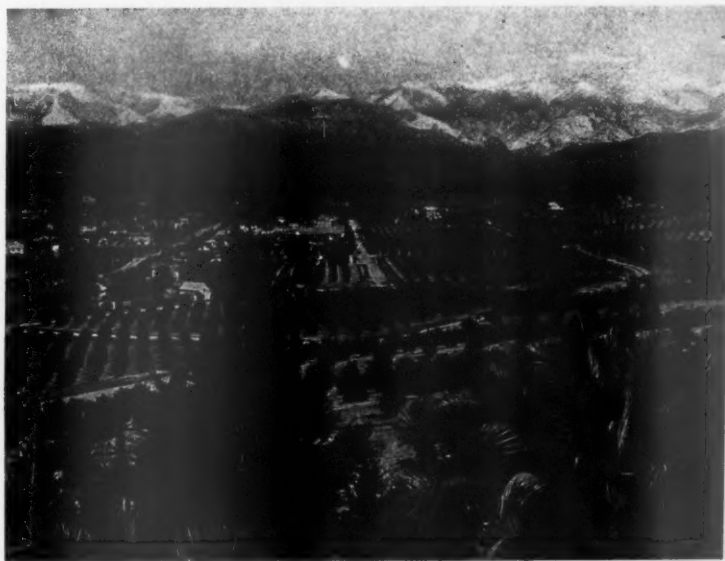
From all these precautions to conserve it, it can be seen that water is the life-blood of the land. As stated before, the highly productive land is limited by the amount of available water, and the intermediate tracts still lie idle. Yet, notwithstanding the present full appropriation and diversion of the streams, it has recently been shown that the valley lies over an extensive underground reservoir, whose resources are as yet practically untried, though known to be almost exhaustless.

The soil is good, and being open and porous, presents no difficulties from alkali, nor from a stagnant water plane, except in the lowest portions, where a comparatively simple drainage system will remove these drawbacks.

It is hard to designate what the climate is like. Each local board of trade



BROOKSIDE AVENUE, REDLANDS. COUNTRY LIFE WITH CITY CONVENIENCES.



LOOKING ACROSS THE SAN BERNARDINO VALLEY. REDLANDS IN THE MIDDLE DISTANCE.

or promotion committee in California claims a distinctive brand for its particular locality, and that brand the best. It is sufficient to say that many health-seekers have found it beneficial. Considered from a restricted agricultural view point, it shows certain peculiarities. The air over the desert to the east is raised to a high temperature during the day, and rising permits an inflow of colder currents. At night these cold winds, when blowing through the passes into the valley, may work havoc on orchards, those lying on the lower levels sought by cold currents suffering most. Citrus fruits, for which this valley is particularly noted, are susceptible to low temperatures, and 26 degrees for a few hours will ruin a crop, while 18 degrees will kill young and 14 degrees old trees. The frost line has never been determined, but it may be stated as a general rule that the high lands up to 2,000 feet are free from frost, and the relatively low lands are subject to it. Many orange orchards in locations once considered frostless have been abandoned or their sites given up to deciduous fruits, and several now known to be endangered by freezing are the subject of a careful solicitude, which expresses itself in lath screens, smudges, and other devices to raise the temperature over the orchard areas. Nearer the coast the frost does not occur, but the temperature, being more equable, does not go high enough to produce the sweetness of the fruit of the San Bernardino Valley, where the thermometer registers in summer some 30° or 40° more than the coast plains.

The rainfall occurs only from November to April, and during the other seven months of the year the sun is practically never obscured by clouds. The atmosphere at this time is excessively dry, and no water is supplied by nature, except in the higher mountains, where thunder storms occur, whose precipitation, falling on bare and steep slopes, runs off immediately, with little advantage to the valley below.

Oranges form the distinctive crop, though lemons are growing in favor and recently some grape fruit has been grown. The oranges are of the seedless

type, developed from the Washington navel, originally produced at the government botanical gardens at Washington, D. C. In addition to these three citrus fruits, olives, almonds, walnuts, prunes, apricots, peaches, pears, and grapes are grown to perfection and abundantly. The income from an acre has been known to reach \$1,000 per year, but that day is past, and will not recur again. It costs about that much to bring an acre of oranges into bearing, so it can be seen that it is not a poor man's venture. Neither is it a venture to be left to friends or investment companies. This has been found out by bitter experience on the part of many, and as a consequence the valley is now a place of homes, owned and cared for by those who occupy them, people of wealth and refinement, who have developed the artistic side of their surroundings to a degree unknown to eastern agriculturists. In other words, it is an ideal country to live in, among cultured neighbors, and with all the advantages and conveniences of a city, without any of the drawbacks.

The water supply comes primarily from the rain clouds which sweep inland from the Pacific during the winter or rainy season, and precipitate their moisture on coming into contact with the slopes of the mountains to the east. Much of this precipitation in the higher slopes is in the form of snow, some of which does not melt until the spring months, keeping the streams at a comparatively even flow. The rainfall in the valley approximates 15 inches annually, but comes in the period of least growth. On the lower slopes of the mountain the streams have grades of from 100 to 200 feet to the mile, with still heavier grades in their granite-walled mountain canyons. Naturally these streams carry down immense quantities of material, which has spread out over the valleys to great depths. This material, formed of coarse particles, overlies clay beds, which appear at certain points in the valley. When the streams leave the hills, they sink into the loose material, one-third of whose mass consists of voids or interstices between gravel particles form-



MAGNOLIA AVENUE, NEAR RIVERSIDE. AN EXAMPLE OF HIGHEST USE
AND BEAUTY ATTAINED IN ROAD-MAKING.



CANAL OF RIVERSIDE WATER COMPANY NEAR RIVERSIDE. EVEN THE
DITCHES ARE MADE ATTRACTIVE.

ing a great underground reservoir whose aggregate storage capacity is enormous and sufficient to carry the irrigation communities through a long period of dry years, and capable of being recharged at times of copious rainfall. The Santa Ana River, the largest in Southern California, in common with other streams of the same region, sinks below this mountain detritus, reappearing only in one or two places where upward folds of the clay sub-stratum forces it to the surface. One clay ridge forms the natural dam of the Upper

form flow to the various wells which tap it. This great reservoir is filled by winter precipitation and by seepage water. Some idea of its size may be gained from the following figures: The entire valley comprises some 563 square miles; the flat area above Colton, presumably all formed by gravels eroded from the mountains, contains 132 square miles. On a conservative estimate, 100 square miles of this is of gravel to great depths, approximating 1,000 feet—numerous wells having been sunk to 900 feet with no indications of bed rock.



THE SANTA ANA RIVER AS IT REAPPEARS BELOW RINCON.

Santa Ana irrigation basin, from which almost all of the water for Riverside is obtained, and forces the river to the surface. At Rincon the underground waters, as well as the return waters from irrigation in the higher parts of the valley, are again forced to the surface, creating wet lands and making available a water supply for Santa Ana and other points on the coastal plain.

Thus we can see that the San Bernardino Valley, whose floor is formed of an open gravel, constitutes a great reservoir or tank, which yields a uni-

Supposing this gravel bed to have an average depth of 300 feet, the total water storage capacity, estimated at one-third of the mass, would be 6,400,000 acre feet, or eight times the storage capacity of the famous Assuân dam of Egypt. Enormous as this seems, it is believed to be greater, rather than less, than the amount stated.

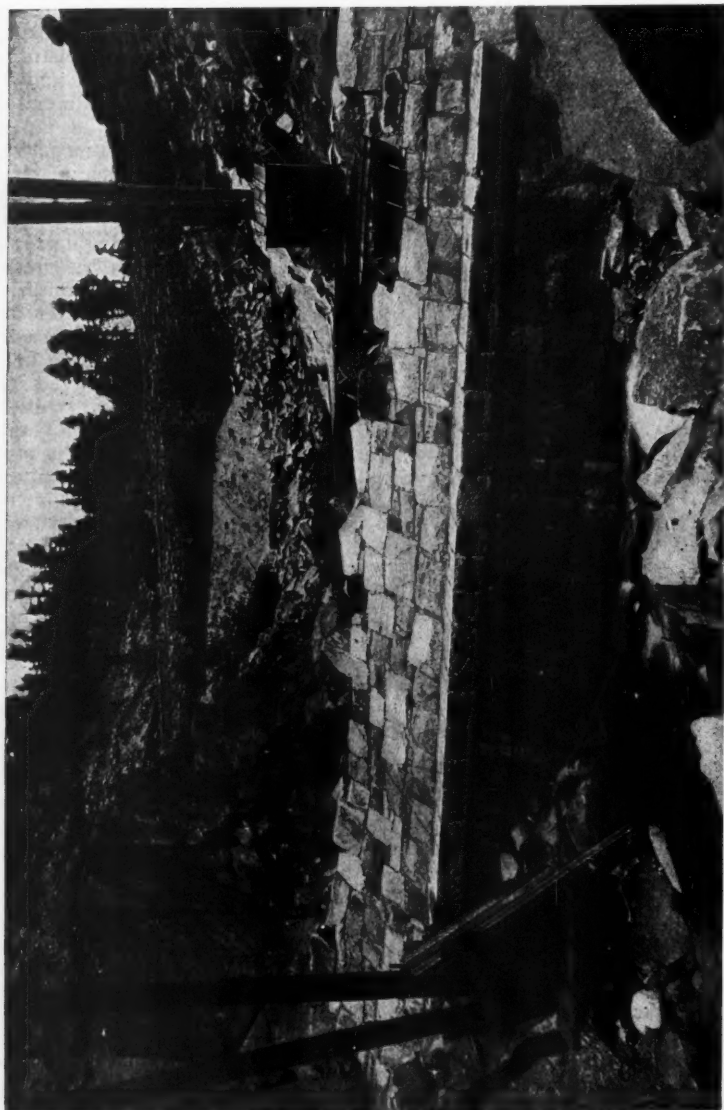
The importance of this reservoir and the limits of its capacity are only beginning to be understood. So far it has not been accurately determined whether the present rate of withdrawal is per-

manently lowering the water plane or whether years of abundant rain will restore it to its fullest capacity. With the running surface water fully utilized, it can be seen that an increase in the available supply must of necessity come from this reservoir, and careful studies will have to be made to arrive at a just and definite conclusion as to the amount which may be drawn therefrom. From experiments in other places it has been fairly well settled that the greater the drain on an underground reservoir, the greater the capacity. Capacity does not mean flow, however. Cycles of dry years have proved that all wells cannot be depended upon. Some have failed altogether, others have had decreased flow, and in several cases the sinking of a new well has resulted in a substantial diminution in the supply of older ones. To the problem that arises from this there is no definite legal solution. How much one well may be responsible for the failure of others is too hard to determine, and the motions and courses of underground waters are too little understood to allow of a legal adjudication of rights, and the only possible remedy lies in one of two very simple and similar ways: One is to have enough water for all wells, and the other is to have only enough wells to properly tap the water supply. It can be said, however, that wells in the central and deeper portions of the valley have no difficulty whatever, and only those shallower ones around the edges of the underground basins will fail when the water plane is lowered through successive demands on it.

It is stated that lands adjoining the San Gabriel and San Bernardino Mountains once had abundant water for all purposes, but that repeated cuttings and burnings destroyed the forest cover of the hills and the water could no longer be properly conserved. If these facts are absolutely correlated, the questions of forestry and irrigation, for that part of the country at least, are closely wedded. It is of course true that the first demands for water were not as great as present ones, but a glance at the granite walls of the many stream canyons, devoid of humus, shows that much of the winter precipitation must run off

over the surface of the ground, which might easily be saved for gradual run-off in perennial streams if there were an adequate forest covering. The comparative absence of reservoir sites on the valley side of the mountains makes a forest cover to retain the moisture a more urgent necessity, and it may be said that the United States Bureau of Forestry is at present carrying on extensive tree-planting operations, with the assistance of individuals and associations of that part of California. Even now a government agent is investigating the possibility of inducing a growth of hardy chaparral, such as greasewood, scrub-oak, and manzanita, in order to see its value as a water conservator, at least until such time as conifers may grow large enough to be of value, and to furnish protective shade for the early growth of better trees.

Details of the many irrigating plants, canals, ditches, and wells might properly be given here if space permitted. Mr. Lippincott's publications, given in special reports of the Geological Survey, from which many of the facts and the illustrations of this article are taken, have a valuable bearing on these points. The Bear Valley irrigation dam, however, deserves some mention, as it is the only storage dam of considerable size in the region. At the time it was built it was the cynosure of irrigation engineers, not only from the promises its promoters held out, but because it formed a reservoir having few equals in southern California. Since its inception the Bear Valley reservoir has had a checkered, not to say mottled, career. From every standpoint the project proved to be queer. In the first place, the dam was built in seeming defiance of all structural rules, so that even a usual stress, by all the tenets of engineering, should have caused its downfall. But notwithstanding this, the dam has stood and done good service for more than fifteen years. It is a curved dam, with arch upstream, built on the gravity principle, with the weight of masonry alone to resist the water pressure of a full reservoir. The resultant of these two forces, according to good engineering, should fall within the middle third of the base



BEAR VALLEY DAM IN BACKGROUND, WITH STRENGTHENING MATERIAL THROWN AGAINST IT. FOUNDATION OF INCOMPLETE DAM IN THE FOREGROUND.

of the dam; but here the intersection of the forces is outside the outer toe of the structure, and the overbearing force is much greater than the dam's gravity. The arch theory is not altogether applicable, as a vertical arch transmits the strain to the abutments from a compression or spring in the masonry. This cannot be altogether true with the Bear Valley dam, acting horizontally as an arch laid on its side, for the foundation or lower side of the arch is sealed to the bed-rock of the canyon and any spring here would mean a loosening of the base and a demolition of the entire fabric. The dam, in spite of its service, has never been considered quite safe, however, and various devices have been used to assure its stability. At the time it was built much was sacrificed to economy, Portland cement being \$15 a barrel at the site.

If its engineering features were complex and questionable, its administrative ones were even more so, and can be summarized in grossly bad management, which took the forms of broken contracts, the payment of 15 per cent dividends from sale of bonds instead of from earnings, and other equally reprehensible measures. Under such circumstances the company was bound to fail, and the failure was so complete after such brilliant prospects that the news, reaching everywhere, did more to injure the reclamation of the arid West than any other one disaster. Its prominence at home and abroad and its first success, so widely quoted, being followed by so signal a failure, made ill advertising for southern California. Now, however, and within the last month, all affairs concerning the dam and reservoir have been rehabilitated by the formation of a water users' association on the basis of those required for government projects, as exemplified at the Tonto site in Arizona and the

Gunnison River project in Colorado. New sites have been surveyed and better dams will be built, not only for irrigation, but for power.

The new plan will mean an increased water supply from reservoirs, and the establishment of electric power pumping plants will assure a fuller utilization of underground water. In general, with the efforts at reforestation of the mountains and the greater knowledge constantly accruing from the work of competent engineers, it looks as if the present water supply for the valley may be not only fully conserved, but augmented. The canals are models for the world, using much cement construction, the material being a home product, manufactured at Colton. Tests and analyses show it to be superior to imported cement in fineness and tensile strength.

It may be stated that a large percentage of irrigation water returns to the stream channels, and in considerable amounts where the soil is porous; that this volume of return water will increase as irrigation is increased, and that there is abundant promise of a greater water supply. Several possible reservoir sites in the mountains, perhaps on the eastern slopes, may yet be utilized, and, while the expense connected with such utilization will be great, the accruing value to lands will justify it. In spite of the failures of many wells, it can therefore be seen that the San Bernardino Valley is really not at the end of its water resources. With the first bitter experiences as to water and stock sales, with their consequent personal suffering, the memory of which still rankles as a "horrible example" to be avoided, and the new regime inaugurated, as recognized by the formation of water users' organizations, it looks as if the San Bernardino ranchers were just beginning to enter fully into their rich inheritance.



BAMBOOS IN THE UNITED STATES.

CULTURAL POSSIBILITIES OF THIS IMPORTANT GROUP OF
PLANTS IN FAVORABLE LOCALITIES IN THIS COUNTRY.

BY

LESLIE HARRISON.

IT has been stated as a generic truth that the peoples of different regions of the globe have each their special tree, without which life would be a much more complex affair. Thus we find desert tribes north of the Sahara using the date-palm to supply nearly every bodily need; the South Sea Islanders have their bread-fruit tree, which furnishes food, textiles, and lumber, and at many places in the tropics the cocoa palm serves these same uses.

To the Japanese and Chinese the bamboo serves many purposes for which no other growth would be at all suitable, its main uses being two-fold—for food and lumber. For the first of these the young shoots are used, much as asparagus, and prepared in the same general way. For the second, it is impossible to give a complete idea of the many ends to which the plant is adapted, but some idea of the qualities which make it valuable to Oriental peoples may be gained by an enumeration of the things for which White Pine is best adapted in this country and then multiplying these several times. For building purposes, furniture, cloth, paper, receptacles of any sort, or almost anything one can conceive of, this giant reed is adapted.

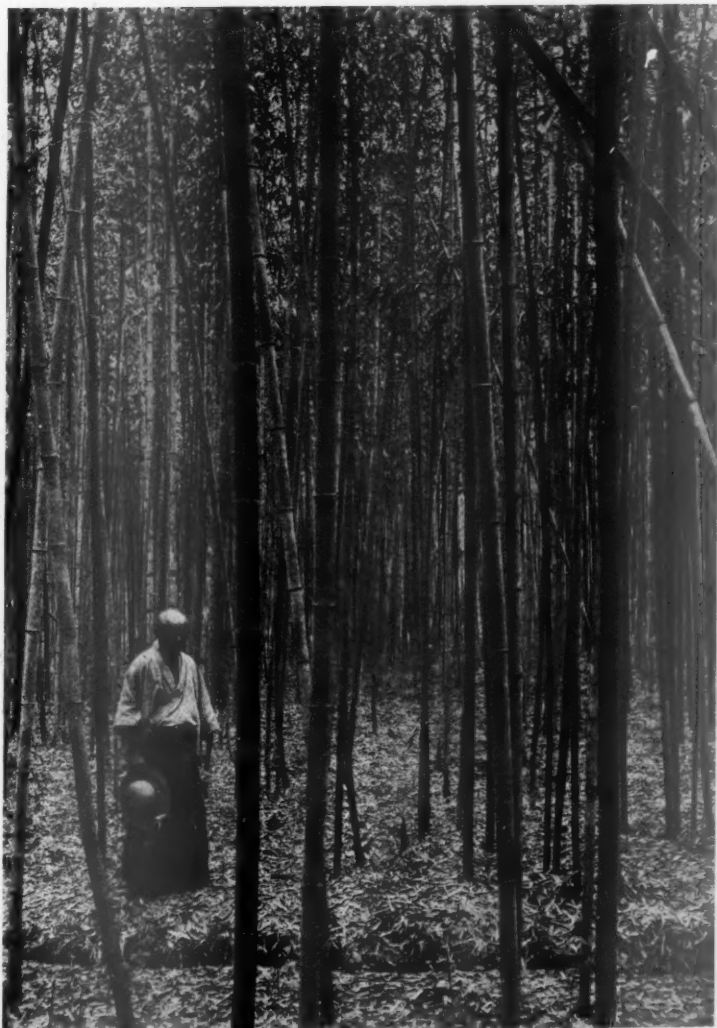
Moreover, its greatest usefulness comes from its accessibility and complete readiness for service. When anything is wanted in a Japanese household it is customary to go out to the bamboo wood-lot, which would be in what an Occidental might designate as the back yard, if the æsthetic Japanese had such an unsightly inclosure. There material could be cut and used at once for a water pail, pipestem, basket, or roof-tree. In some cases it is true that metal might be a better material for articles manufactured from bamboo, but it is

not so conveniently at hand nor so easily worked into the desired product.

It must be stated in the beginning, however, that in spite of the talk of bamboo groves and forests and a recent popular song, "*Under the Bamboo Tree*," that the growth is not in any sense tree-like save in the matter of size, and in any consideration of this group of plants their essential characteristics as grasses must be kept in mind. Yet they are not like grasses or grains in their economic significance, for they do not yield prompt returns in money, being essentially wood-producing plants, susceptible to forest methods, whose timber is suitable for many manufactures for which other woods are not adapted.

In Japan, where bamboo culture has been brought to its highest state, the bamboo groves constitute prominent features of the landscape and the most profitable of all plant growths. It is a necessity to the Japanese peasant, a delight to the artist, and a material for works of all sort, from the crudest fence to the most delicate creations of the handicraftsman. Americans see many of these latter, and find in the split sticks of various fans an example of a peculiar use of the wood.

While the plants have the power of producing seeds, they flower infrequently, perhaps twice in a century, and then only a few of the blossoms form seeds. This being the case, the bamboo has an effective system of reproduction through rhizomes, or underground shoots, which send up new stalks or culms, and these in turn are capable of the same reproduction, making a progressive growth, which not only increases the number of culms but enlarges the area of a bamboo grove from year to year. Each new shoot is in-



A WELL-KEPT FOREST OF TIMBER BAMBOO ON GOOD SOIL, SHOWING THICK MULCH OF STRAW AND LEAVES, AND OPEN DRAINAGE DITCH IN FOREGROUND



A TWELVE DAY SHOOT OF TIMBER BAMBOO.

cased in a hard shell formed of leaf-like sheaths which protect the tender stem until it has attained its full growth and is ready to branch. The rapidity with which these new culms grow is remarkable, and one can hardly judge the age of the growth by its size. Over a foot a day is not unusual and a rate of 3 feet in 24 hours has been recorded. A twelve-day-old shoot of the larger varieties is man-high, and in less than two months the same culm may be upwards of 20 feet. Travelers have told the story of a horrible oriental punishment where a criminal is condemned to death by being fastened to the ground over a new culm, which in the course of a day, with its hard sheath-like exterior, will pierce through the body, inflicting a terrible death. Whether true or not, this is illustrative of the rapid growth. There is some reason to disbelieve the story, as the young shoots are, in the main, quite tender, and may be snapped off by a mere shaking. Until the young

culm has attained its full height, it sends out no branches, in this respect having another analogous feature with asparagus. The lower divisions, or nodes, produce no branches or leaves and in a well-kept forest there is no foliage within 20 feet of the ground. Bamboos mature, however, in about four years, and while a grove may be upwards of fifty years old, individual plants rarely exceed five or six years. Less than four-year-old timber is immature, and old wood becomes scarred and yellow and loses its elasticity.

The leaves themselves are borne on short lateral branches, and are so light and graceful that at a distance they have a feathery appearance. They vary greatly in the different varieties, but have a general lanceolate form, and while the forest forms have leaves averaging about four inches in length, some are nearly a foot long and six inches wide, and are used for wrapping material.



NEW CULMS IN BAMBOO GROVE. AGE OF TREES, ABOUT 50 YEARS.



YOUNG TIMBER BAMBOO NEAR NILES,
CALIFORNIA. WATERED TWICE A
YEAR WITH 2 INCHES OF
WATER EACH TIME.

In any consideration of its introduction into the United States, several things must be taken into consideration, including its economic and æsthetic value, and what is of primary importance, its adaptability to conditions and its general qualities of hardiness.

Of the first of these considerations, it may be said that already there is sufficient evidence of its value to assure its welcome as an economic product. The bamboo fishing-pole, for example, has never been supplanted, and there is a very considerable trade in bamboo furniture, the assembling of which is undertaken in this country, in order to take advantage of import duties, which are less on the raw material than on the finished product. The host of things which can be improvised from this "giant grass" should make it especially appeal to Americans, who are

said to be the "handiest" people in the world, and the fact that no expensive or long process of seasoning or curing is necessary to make the wood available gives another peculiar advantage.

It is stated also that the employment of the young shoots of the edible variety as an article of diet is worthy of the serious consideration of American cultivators, for many American residents of Eastern Asia have showed a fondness for the dish, and a demand might easily be created in this country.

Aside from these economic considerations, the æsthetic value is incontestable. Bamboos are among the most graceful plant forms now existing, and add a charm to any landscape. Their plume-like quality has already been spoken of, and whether seen against the sky-line, or backed by denser foliage, they add a peculiar softness which is their chief charm. In this connection it may be said that there is a great range



BAMBOO IN NURSERY ROWS AT NILES,
CALIFORNIA, 25 FEET HIGH.

in size and habit among the different species. Some are so small that they creep over the ground and form a rather rank greensward, while others send their tall stems 100 feet into the air and are more than six inches in diameter. Still other are cultivated only in pots and are used as subjects for the fanciful and grotesque dwarfing methods practiced in oriental plant fanciers.

As screens to hide unsightly fences, corners, sheds, and rubbish piles, no plant can excel them, and the merest hut is transformed to picturesqueness by their use.

Their successful introduction into this county depends on several things, and a first consideration is that a healthy rhizome or underground shoot must be attached to each plant for propagation. Moist, open soils are best suited for the bamboo, yet it will grow with little water, though not at all a plant for arid conditions. Some groves have flourished in California, however, with only two applications of water, two inches deep, during the six months of the dry season. Climatic conditions are not so exacting as many persons suppose. There are many healthy plants in France and England, and in the eastern United States certain varieties will thrive out of doors as far north as Washington, D. C. In California, if hardy species were carefully selected their range need not be limited where soil conditions are proper, except by the cold of altitude, and there are at present extensive groves and even one small forest in that state, some of the best examples being found around San Francisco Bay. At Berkeley, Niles, and in Golden Gate Park, San Francisco, there are some fine specimens, and successful ornamental plant-

ing has added much to the beauty of the campus of Stanford University. A number of the largest and best varieties will live in a temperature as low as 6° Fahrenheit, and in their native countries much damage is done groves by the weight of snow where the temperature has no deleterious effect.

It can be seen, then, that there are many possibilities for bamboo culture in the United States, and that they will find many uses, and perhaps some that even the Japanese and Chinese have not yet discovered. For examples of this we have the case of the first incandescent lights in which carbonized bamboo filaments were found better than any other material; and Santos-Dumont is making extensive use of the bamboo poles in the construction of his airships, having determined on them as giving great strength with minimum weight. Florists, too, should find the foliage of value in decoration, and even for cut-work they possess a peculiar advantage in their quick growth from shoots, so that a plot may be extensively cut over, as long as the roots are undisturbed and left to replenish itself, which it does in a remarkably short space of time.

Any experiments leading to the introduction of new species should be taken only after careful investigations of native and new conditions, and it is well to reiterate the absolute necessity and importance of having a healthy, strong rhizome with each plant, if growth and propagation are to be counted upon.

For many of the facts of this article and all of the illustrations, we are indebted to Bulletin 43, Bureau of Plant Industry, U. S. Department of Agriculture; "Japanese Bamboos," by David G. Fairchild, agricultural explorer.



WATER RESOURCES OF KINGS RIVER, CALIFORNIA.

POSSIBILITIES OF AUGMENTING IRRIGATION
SUPPLY BY THE USE OF STORAGE RESER-
VOIRS IN THE UPPER DRAINAGE BASIN.

BY

ARTHUR W. DRAKE.

THE upper drainage basin of Kings River lies on the western slope of the Sierra Nevada Mountains, with its eastern limit along the crest of the mountains in a line about 50 miles long, or approximately from Mount Goddard on the north to Mount Whitney, the highest peak in the United States, on the south. The distance from this crest to the point where the river debouches upon the valley from its mountain canyon, not far from Centerville, is also about 50 miles. Centerville, as its name implies, is midway of an east-and-west line drawn through the state, and is also approximately equidistant from San Francisco and Los Angeles, being some 200 miles from each.

The Kings River Canyon and the Sierra crest, from which its waters flow, display some of the most rugged and grand scenery to be found in the United States, considered by many who have seen both to be superior to the Yosemite country. Above the 10,000-foot contour, which approximates the timber line, the watershed is glaciated granite. Between this level and the 1,000-foot contour the mountains are covered with underbrush and timber, comprising the most extensive forest of California Big Trees (*Sequoia washingtoniana*) now in existence. Fortunately more than three-fourths of this great drainage basin is included within the boundaries of the Sierra Forest Reserve, and the government will grant no more holdings within its limits, except for mining or the development of water resources. Moreover, the region is patrolled against fires and illegal grazing. This is of the utmost importance in any question of a further development of the water re-

sources of the watershed, and is a full insurance for the irrigated lands in the lower valleys, for it means a conservation of the stream. The action was taken none too soon, because great destruction had already been wrought in the forests by careless lumbering and by fires, and even now, at Millwood, just outside of the reservation lines, the largest grove of Big Trees in the state is being sawed up.

At the present time the importance of Kings River to the irrigation districts lying below it in Tulare, Kings, and Fresno counties cannot be overestimated; yet the irrigation works are in a great measure only makeshifts as compared with the possibilities which have not yet been realized. These possibilities have been pointed out in a survey made under the direction of Mr. J. B. Lippincott, in the employ of the hydrographic division of the United States Geological Survey. The California Water and Forest Association, an organization to promote the irrigation interests of the state, contributed \$1,000 toward the expenses of the survey, and the Kings River Storage Association, a local body, coöperated in the work by a subscription of \$1,500. A remarkably complete reconnaissance of the region was the result, and, in brief, it was found perfectly feasible to increase the supply available for irrigation by the construction of storage reservoirs in the drainage basin. A number of possible reservoir sites were considered, but questions of excessive cost, inaccessibility, absence of material, or other items will preclude the use of most of them.

The country watered by the Kings



FOREST COVER OF THE SIERRAS IN THE DRAINAGE BASIN OF KINGS RIVER. ALTITUDE, 6,000 FEET.



AN EXAMPLE OF WASTEFUL AND DESTRUCTIVE LUMBERING IN THE SIERRA NEVADA.

River irrigation systems lies below the point where the stream breaks from its mountain restraints and spreads out over the alluvial plains below in a number of branches, the country being sometimes known on this account as the Kings River delta. The water from the river is diverted as soon as it gets to this valley, and makes possible all of the crops for which the region is justly famed. On account of the snows of the high Sierras, whose largest melting comes in the spring and summer months, the best water flow comes in the growing season. The wet winter season around Fresno has a precipitation of less than nine inches, and for more than seven months there is no rain. Even in the rainy season the downpour is not continuous, and seldom lasts for more than a few days at a time, there being less than 100 days in the year which are not sunshiny. The summers are hot, with an average temperature of 80°, though the dryness of the climate keeps the heat from being oppressive. The mean average winter temperature is about 60°, and some localities in the foothills, where citrus fruits are grown, are locally known as "frostless." Health reports indicate that Fresno has the lowest death rate of any city in the state.

The Kings River delta has a variety of valuable products hardly equaled in any other part of the world. Lumber, gold, copper, petroleum, grain, fruit, and fruit products, such as dried or canned fruits, and wines and brandies are produced in valuable commercial quantities. Irrigation, as has been stated, is essential to the growth of all agricultural products, with the possible exception of grain crops, whose value is greatly enhanced by the presence of water.

The river is never wholly dry, as is the case with many California streams, as the glaciers and permanent snow banks of the Sierra crest keep up a constant supply of water. The period of minimum flow is in the early fall months, when there has been no precipitation for a long time and the summer melting has been complete. The rains of the late autumn increase the flow a little, but

the greater part of the precipitation in the mountains is in the form of snow, which is kept until the warm sun and spring rains of the following year liberate it. After the midwinter season the river increases in flow until it reaches its maximum discharge about the first of June. The proposed works will take advantage of this discharge, and hold it for gradual use during the rest of the summer, or even for use during a long succession of dry years.

Without going into engineering details, which may be found in special papers published by the Geological Survey, from which the accompanying illustrations are taken, it may be stated that four principal reservoir and dam sites have been selected as the best available, and these should be sufficient to make fullest use of the water of Kings River. Two of these should not be considered separately, save for purposes of description, as they form integral parts of one system. Though economic considerations are of the first importance, it is worth while to note that the grandeur for which the Kings River Valley and canyon are so justly famed is not in any case impaired by the works projected, and in fact the lakes which these reservoirs will form will undoubtedly add new beauty to the country in which they are situated. The four reservoirs which have the approval of those who made the investigations take for their possible sites Clarks Valley, not on Kings River proper; Pine Flat, in a long valley a short distance above the point where the river joins the plain; Dusy Meadows, on the north fork of the river, and Long Meadow, on Ten-mile Creek, near the junction of the Middle and South forks of Kings River. The two last named sites lie well within the limits of the Sierra Forest Reserve.

Of these four sites Clarks Valley is the most important as covering the greater acreage and storing by far the largest quantity of water. As stated above, it does not lie on Kings River, but about 1½ miles from the main drainage basin. It is proposed to divert water from the river by means of a tunnel and canals. To make this basin available, three separate dams will have to be



UPPER DRAINAGE BASIN OF KINGS RIVER.

built, as three isolated buttes enclosing the lower end of the valley can be used to form part of the retaining walls. The valley basin is that of Wahtoke Creek, whose waters are now used for irrigation, but whose drainage basin would be totally inadequate to store enough water to make the dam worth while.

Pine Flat reservoir may be considered, although not the largest, still the key point of the system. This reservoir will not only take up water which would otherwise run largely to waste, but would aid greatly in the filling of the Clarks Valley reservoir, and after that was filled it would still be available for storage. Its importance is found from the facts that it will still be full after all winter and summer irrigation on the present basis has been supplied; that this water would be that which would

otherwise be lost, and that its height would enable it to irrigate the best lands in Tulare and Fresno counties, now unproductive. The cost of the reservoir, too, would be many times less than its earning power. With both reservoirs, the Clark Valley and Pine Flat, completely filled, more than three-fourths of the discharges of the river could be utilized for irrigation. The two sites above, Dusy Meadows and Long Meadow, would be used for feeders for the reservoirs below, and would serve to equalize the flow on the lower reaches of the river. There would be no danger from floods from the Clarks Valley reservoir, the principal distributing one of the system, as its drainage basin is too small to allow of a great enough precipitation to cause trouble.

Yet the water storage for irrigation

KINGS RIVER AT UPPER END OF CENTERVILLE BOTTOMS, SOON AFTER LEAVING THE MOUNTAINS. VIEW LOOKING UP STREAM.



is but a part of the beneficent results to follow the construction of dams and storage reservoirs on Kings River. The development of enormous electric power for transmission to the varied industries of the valley also promises wonderful results, and such power, in a large measure, may be obtained from the waste water over these weirs. Leaving out the value for lighting and for power in many industries, there is a direct value to irrigation in the use of this power for pumping plants in the many wells found in the valley near Fresno and Hanford, and an indirect one in the relation that this pumping will bear to the alkali problem, which is a serious one in certain localities. That is, the pumping will tend to lower the water table which, under the application of irrigation water, rises and brings to the surface harmful salts. Mr. Thomas H. Means, of the U. S. Soils Survey, who has made a personal inspection of this region, and who is at present at Fresno investigating the results of a reclamation experiment being carried on by his bureau, finds that this problem resolves itself around certain well-established facts. These are, that the waters of Kings River are so pure as to add nothing to the present alkali content of the soils, and thus the main question is to get rid of those present without having the complication of new sources of alkali to contend with. Drainage is being relied on to carry off much of the seepage water from irrigation, and this work will be assisted by the work of the pumps. Of course they would draw their water from below the land, and it would seem that this would concentrate the salts near the surface; but this would not necessarily follow. Pumping would rather tend toward a gradual elimination of the harmful saline qualities, and in this way: Part of the water drawn to the surface would be evaporated, part used by plants, and part would drain away into the rivers. The addition of the sweet waters from Kings River would more and more dilute the ground supplies, and in the course of time the amount of alkali in the soil

would be appreciably diminished. Then the gradual distribution of the alkali through the lower soil, by the lowering of the water table, would further decrease harmful quantities at the surface, where they come in contact with the plant life.

Summarizing, it may be stated that the most important results of the investigations on Kings River show that an increase of 400,000 acre-feet of water is possible, over present supplies—an amount sufficient to bring under irrigation 200,000 additional acres on the basis of 2 acre-feet or 24 inches depth of water over an acre each year as the established duty of water for the region. This increase in supply would cost only a little more than the present supply from gravity canals whose headworks are mere wattles of brush and cobbles. Moreover, the additional acreage brought under cultivation in the foothills will mean a big increase in the growing of valuable crops of citrus fruits, the most profitable of all on areas now untitled.

The Dusy Meadows and Long Meadow reservoir sites are not altogether necessary, better sites being available. The Pine Flat and Clarks Valley sites are, however, of great value to the irrigation districts which obtain their water supply from Kings River. The pumping plants would furnish cheap and abundant water supply, and will at least partially prevent the rise of alkali to the surface of irrigated lands. There is now being wasted from the river 200,000 acre-feet of water, which can be made available by storage dams, which are known to be practicable and safe from an engineering point of view; and, at costs not to exceed half the amounts gained, irrigation works may be built which will add from \$50 to \$100 value per acre to lands which are now dry. The object of the investigation which has made these facts available has not been to recommend that the works be built either by private capital or public funds, but the results obtained indicate that they would be a profitable venture for either.

TWO UNIQUE DAMS.

SOUTHERN CALIFORNIA MOUNTAIN WATER
COMPANY'S WORKS NEAR SAN DIEGO, CAL.

THE operations of this company have interest and value in connection with discussions of reclamation, because experiments in new methods of construction upon a gigantic scale are being made, and waters of comparatively insignificant streams are to be stored. This differs widely, however, from any project of national works for conservation of waters, in that the lands to be benefited are urban and suburban in character. In its financial features the project is comparable to the great reservoir being built by private parties for the city of Denver and surrounding lands, or that for the city of San Francisco and the Bay counties. There are already lands partly tilled and a dense population needing an additional supply. The water when held in the reservoirs will be controlled and distributed through pipes. In contrast to this are the conditions upon the inland desert areas, where population cannot gain a foothold until works have been built.

The city of San Diego authorized the issue of a large amount of bonds to assist in constructing these works, and from the bonus thus received, and the speculative features resulting from ownership of great tracts subdivided into town lots, it is believed that this water-storage enterprise can be made financially successful. Figures as to the cost of the enterprise are not obtainable, as the matter is one of private speculation and there have been a number of experiments made on a large scale.

The principal works consist of two large storage dams. The first, known as the Upper Otay, is on the west fork of Otay Creek; the dam is of masonry, curved upstream. It is located in a porphyry-rock gorge, the width between walls being but 20 feet at base. At the 120-foot contour the reservoir has a surface area of 452 acres and a capacity of 15,300 acre-feet.

Below this is the Lower Otay dam, on Otay Creek, backing water up to the foot of the Upper Otay dam. It is located 20 miles southeast of San Diego, and 10 miles back from the coast. It is one of the most remarkable structures in the country, being built practically without preliminary plans, estimates, or experienced engineering advice. It was originally started as a masonry dam, but the builder decided to try the experiment of using a steel core or diaphragm. This is held in place by immense piles of rock. The steel plates are riveted together after the fashion of a huge tank, and are protected on each side by a layer of asphaltum and another of concrete. The expansion of the plates after they were riveted has given the sheet a wavy outline, although it has been brought to as nearly a straight line as possible, extending from one side of the canyon to the other.

Water for the reservoirs thus formed by these dams is to be had partly from storms occurring upon the catchment basin of Otay Creek and partly by diversion from adjacent catchment areas, being brought across the divide by flumes and tunnels. The principal subsidiary work of this character is the Morena dam on Cottonwood Creek, a tributary of the Tia Juana River. This dam is located 7 miles north of the Mexican boundary, and about 50 miles from San Diego. Water from the reservoir thus formed is to be turned into Cottonwood Creek about 8 miles below what is known as the Barret dam; thence it will be carried through the feeder for the Lower Otay dam, a portion going to this reservoir, and a portion to the city of San Diego. Litigation over the validity of the contract to supply the city has delayed the execution of much of this work, but from now on development should be rapid and the works thoroughly successful.

FOREST FIRES IN JULY.

THE DANGER AREA HAS MOVED TO THE FAR WEST, WHERE THE EFFECTS OF SUMMER DRYNESS ARE ALREADY SHOWN.

IN accordance with the rule now generally recognized, that the most disastrous fires are apt to occur in the spring and fall months on the Atlantic coast, and that the Pacific coast is in most danger between July and October, there have been practically no forest fires in the eastern states since June, when those of the Adirondacks and the Maine woods were effectually extinguished. Following the same rule, the forest-fire zone has shifted to the far West, and California has had several serious blazes, not only in her forests, but in the dry grain fields and pastures. The average easterner has no idea how very dry it gets in that state during the long summer, when the soil bakes and cracks, and the luxuriant vegetation called forth by the warm spring rains withers and dies, leaving the ground covered with highly inflammable material ready to burst into blaze from the slightest spark.

The following are the most serious fires reported during the past month:

California.—The most damaging fires in this state occurred in Santa Cruz county, most of them being in the neighborhood of the city of Santa Cruz. They were reported as burning July 2, and swept over much territory in the Santa Cruz Mountains, in one place following the summit for about eight miles. On the Santa Clara side of the mountains they burned near Los Gatos but did little damage, as they soon came to burned-over lands. These fires were fought systematically and unremittingly by large bodies of men, who succeeded in saving much property and in averting possible loss of life. Fires in this neighborhood also endangered the timber in the Big Basin Park, the flames threatening from the south and west. Fighters from Boulder Creek kept the fire from making inroads in the timber of the park on July 6, but on the 18th fire did gain

access by crossing Waddell Creek over a fallen tree. The park rangers checked this by back firing. No campers have been allowed in the park, with the exception of a government party in the employ of the Geological Survey, so the danger from camp fires has been minimized. Monte Rio, a summer resort village on Russian River, in the western part of Sonoma county, was nearly destroyed by forest fires in the neighborhood on July 5, but effectual fighting saved the town, although the woods were ablaze all around it. In this case the danger would never have proved threatening if the villagers had put out the fire when first discovered instead of letting it go with the thought that it would do little damage. Mount Jackson, a peak between Guerneville and Forestville, was swept by flames on July 2, the carelessness of campers starting the fire. Considerable property was destroyed by this fire, as well as by one which burned between Mark West and Healdsburg. On July 2 several buildings of the Glen Blair Redwood Company, on Pudding Creek, 6 miles from Fort Bragg, Mendocino county, were swept away by a forest fire which was started by a donkey engine in the woods. Some valuable timber was also burned. July 18 a fire in the woods near Nevada City wiped out many acres of timber and cut off the city's water supply. This fire was due to the carelessness of a camper. Fires in Green Valley near Napa, not far from the Vallejo Water Works Dam, and in Wildhorse Canyon, not far from Vallejo, were also presumably started by campers, and did considerable damage to timber on July 3. A forest fire started in the Yosemite Valley July 19, but was extinguished by the National Park rangers, with the assistance of a troop of cavalry from Wawona; not until considerable damage was done, however. Sparks from a locomotive started a fierce

fire just south of Shasta Retreat, a resort near Mt. Shasta, which was seriously threatened. Prompt fire-fighting minimized the damage and saved the village. Fifteen small fires got started in the San Bernardino and San Gabriel forest reserves in the southern part of the state, but did little damage on account of the effectiveness of the fire patrol. Losses to grain and pasturage and to other property from widespread fires over ranches in several parts of the state amounted to no less than \$175,000 during the first part of July. The fires were caused by sparks from locomotives or traction engines, by campers, and in some places by the attempt to have fireworks on July 4.

Washington.—A fire raged in the woods two miles north of Woodinville, Wash., but did no damage to property other than standing timber. This blaze was of incendiary origin, and Fire Warden Reed arrested J. B. Smith at Woodinville on the charge of starting the fire, which was, luckily, got under control by the warden and the men he engaged to help him.

Minnesota.—Black Duck, 25 miles north of Bemidji, Minn., was threatened by forest fires July 1, and assistance was asked from the latter place. Much timber and some homes were destroyed; but when the town was surrounded by flames and its case was presumably hopeless a heavy rain passed over the section, quenching the fire. Owing to the prompt action of railway officials, a fire which threatened the town of Farris near Cass Lake, was extinguished by a crew sent on special train. The forest was found to be ablaze in two places, and although considerable damage was done to standing pine, it is believed that an awful fire was averted by the prompt reporting and subduing of the flames.

Colorado.—A fire in the vicinity of Berthoud Pass, near Idaho Springs, which burned for three days, July 11 to 13, is reported to have destroyed 1,000 acres of timber before rains quenched

it. A party of fighters, aided by a wind which blew up the pass, kept the flames confined to an area bounded by the steep slope of the mountain, which was covered with snow, against which the fire could make no headway. Had the wind changed there would have been a serious conflagration.

Alaska.—The Alaskan telegraph system, employing a line 1,800 miles long, was completed on June 20, and a few days later was opened for communication. Four days after that 100 miles of the system was destroyed by forest fires, the fire region beginning about 50 miles south of Fairbanks. The most severe fires were burning in the Tanana Valley and are likely to continue for some time. They were first reported just before communication was cut off in the early part of July, and on July 18 were still burning, with no sign of abatement. It is said that communication cannot again be established inside of six months.

Of the foregoing fires, it can be seen that almost all were caused by carelessness, with the usual portion laid to the doors of railway companies which did not provide spark-arresters when going through dry country. The damage done by locomotives was reinforced by that of traction engines. Ignorant and foolish campers were more than ever in evidence. The attempt to celebrate the Fourth of July was the direct cause of some fires in California. In the case of Monte Rio a serious disaster was averted almost by miracle, when a little prevention would have eliminated all danger in the first place when the blaze was discovered. The care being exercised in the California forest reserves and the Big Basin Park are gratifying to note, and the prompt reporting of the fire near Cass Lake, Minn., by the J. J. Hill special train, with the subsequent quick and effectual stamping out of danger, deserves special commendation.

RECENT PUBLICATIONS.

Any of these books will be sent by the publishers of "Forestry and Irrigation," postpaid, to any address on receipt of the published price, with postage added when the price is marked "net."

The Call of the Wild. By JACK LONDON, author of "An Odyssey of the North," "Children of the Frost," and other stories. Pp. 231. Illustrated in color by Philip R. Goodwin, Charles Livingston Bull, and Charles Edward Hooper. Published by Macmillan, New York. Price, \$1.50.

"The Call of the Wild" is a dog story and a marvelously good one, fit to rank with those classics, "Rab and His Friends," by Dr. Brown; "A Dog of Flanders," by "Ouida," and is even better than "Bob, Son of Battle," by Alfred Oliphant, though it has so much that is new in plot and treatment as to render it almost impossible of comparison. The story is a stirring one, strongly told, of a house dog, part St. Bernard and part collie, stolen from a California home to become a sledge dog in the first rush of the Klondike excitement. The different chapters recount his relations to his various masters and the other dogs with whom he comes in contact, and ends with his atavism in the call of the wild, when he becomes a wolfish leader of wolves after the last tie that binds him to human kind has been destroyed. This is perhaps the best thing that Mr. London has done.

Tree Planting on Streets and Highways. By Col. WILLIAM F. FOX, Superintendent State Forests, New York. Pp. 50. Illustrated by photographs and colored plates. Published by the Forest, Fish, and Game Commission, State of New York, Albany, 1903.

Much of value has been gathered in this treatise on tree planting, for urban and suburban use, and the subject has been pleasingly presented, especially in the illustrations. Desirable and undesirable species are fully discussed, and one part of the work is devoted to the question of autumn foliage in its bearing on the selection of trees for beauty. This part is illustrated with colored plates, and forms a very attractive exposition of the merits of the different trees. The work is really entertaining and could be read with pleasure as well as profit by those who love the trees and care for the beauty which they add in any locality.

A Biological Reconnaissance in the Vicinity of Flathead Lake. By MORTON J. ELROD, Professor of Biology, University of Montana. Pp. 182 and 44 plates from photographs. Published by the University of Montana, at Missoula.

This reconnaissance covers the country around Flathead Lake, Montana, and gives a good idea of the various forms of animal life which may be found in and on the lake and among the mountains which surround it. All of the work has a scientific value, though

much of it is presented with the express purpose of avoiding the overtechnical, which gives the bulletin something of the character of a "nature book." It is a nature book in the best sense—a record of things seen out of doors, with no straining after effects in their description, but with a close attention to the facts as they were found. Some of the descriptions of trips taken by the naturalists in Professor Elrod's party make interesting and pleasant reading, not only to those who know or want to know that section of Montana, but to any one interested in outdoor life.

The "Bluing" and the "Red Rot" of the Western Yellow Pine, with special reference to the Black Hills Forest Reserve. By HERMANN VON SCHRENK, Chief of the Division of Forest Products, Bureau of Forestry. Pp. 40, with 15 plates, some of them in color. Published by the Department of Agriculture, Washington, D. C., 1903.

After a thorough discussion of the fungus growths which cause the characteristic "bluing" and the "red rot," the author goes into the cause of the matter and finds that the diseases generally follow the ravages of the pine bark beetle. The general findings are valuable and will prove so to lumbermen in general and the railroad men in particular, who use much of the wood for tie timber. He recommends the removal of all dead and dying wood from the forest if the spreading of the disease is to be checked; and to further this removal he suggests that the dead and beetle-infested timber be sold for a nominal price to any one who will apply for it and guarantee its removal.

Forage Conditions and Problems, in Eastern Washington, Eastern Oregon, Northeastern California, and Northwestern Oregon. By DAVID GRIFFITHS, Assistant in Charge of Range Investigations. Pp. 52, with 9 plates. Published by the Department of Agriculture, Washington, D. C., 1903.

A wagon ride through the states enumerated in the title to the work, for the greater part away from the railroads, and in one or two places about as far as one can get from a railroad in the United States, has given the material for this exhaustive study of conditions in the heart of the great range area of the United States. The writer has made a number of recommendations in regard to over-pasturing, and points several ways in which the ranges might be improved with little trouble and to great advantage. Several native grasses are recommended as worthy of cultivation, and two new alfalfas are deemed worthy of introduction—one a variety that will survive with less water

than the common form and one which will be more alkali-resistant. The development of these two strains will necessitate careful experiments, though the material collected in the Sahara last summer by Thomas H. Kearney, of the Bureau of Plant Industry, may supply at least one of the needed varieties

Seasoning of Timber. By HERMANN VON SCHRENK, assisted by REYNOLDS HILL, Agent, Bureau of Forestry. Pp. 48, with 18 plates. Published by the Department of Agriculture, Washington, D. C., 1903.

This report concerns itself altogether with the seasoning of tie timber, though the general properties and the value of seasoning in all timber is touched upon. It is meant for the special benefit of railroads, and makes many valuable recommendations in the methods to be employed in treating ties from the time they are cut until after they have been laid in the road-bed. The folly of some of the present slipshod methods of treating, or rather, mistreating, ties, is exposed, and the proper methods are carefully given, with the reasons therefor.

Long's Wood Folk Series. By WM. J. LONG. Each volume contains about 180 pages, with illustrations by C. D. Copeland. Price, 50 cents each. Published by Ginn & Co., Boston, Mass.

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Mosses with Hand Lens and Microscope. Part I. By A. J. GROUT, Ph. D., Teacher of Biology, Boys' High School, Brooklyn, N. Y. Pp. 86, with many text drawings. Price, \$1.00. Published by the author, 360 Lenox road, Flatbush, borough of Brooklyn, New York city, 1903.

There will be four or five parts of this work, the whole series forming a non-technical handbook of the more common mosses of the north-eastern United States, the purpose of the work being to give the information necessary to enable any one to become acquainted with the commoner mosses with the least possible outlay of time, patience, and money. For the amateur collector it will be a unique and helpful series, and it will form a notable addition to the literature on American mosses. The book is well written and the letter-press is unusually fine and attractive.

The American Fruit Culturist. Containing practical directions for the propagation and culture of all fruits adapted to the United States. By JOHN J. THOMAS, First President of the Fruit Growers' Society of Western New York, etc. Twenty-first edition, revised and enlarged by William H. S. Wood. Illustrated with over eight hundred accurate figures. 8vo, pp. xvii, 823. William Wood & Co., New York.

The strongest testimonial that can be paid the "American Fruit Culturist" is the mere announcement of the twenty-first edition. A book that has been a standard work for twenty-five years and has gone through so many editions must possess considerable merit.

While compiled accurately from a scientific standpoint, it is meant especially as a working manual for farmers and amateur fruit growers. No material changes are noted in the present edition except in the bringing of all topics up to date as knowledge has been gained on the several subjects. Professor Slingerland contributes a chapter on "Destructive Insects," Professor Halstead one on "Diseases of Fruits," and Professor Bailey supervised the entire work. "The Culturist" has grown from 758 to 823 pages, and the illustrations have been materially increased. Taken altogether, it is the best single volume on the subject of fruit growing.

Bulletin from the Laboratories of the State University of Iowa. Vol. V, No. 3. Published by authority of the Regents at Iowa City, 1902. Pp. 334. Illustrated by nine diagrammatic plates.

"The Coleoptera of Colorado" and "Descriptions of American Uredineæ, IV," make up the whole of this bulletin, and for the most part are mere lists of the beetles of Colorado, with their localities, and purely technical descriptions of some of the plant "rusts" found in America. Both papers are carefully prepared and should be valuable to scientific readers interested in the subjects treated.

Educational Directory of South Carolina. Published annually by J. M. SHERIDAN, Greenwood, S. C.

An exhaustive list of school teachers, county superintendents, principals, and other persons connected with the educational activities of South Carolina.

Farmers' Weirs. By S. FORTIER, Director of the Montana Agricultural Experiment Station of the Agricultural College of Montana. Pp. 29. Illustrated by diagrams and drawings. Bozeman, Montana.

This publication is the first of a series of farmers' bulletins on irrigation topics, and gives the salient points of one method of measuring water which is in more or less common use. The general question of water measurement is described, with the reasons for such measurement, and there are specific details for the construction of weir boxes which will give accurate measurements, without which ques-

tions of water distribution cannot be adjudicated under the laws of Montana. The bulletin will have a value, however, for any locality where it is desirable to measure irrigation water.

Eighth Annual Report of the Chief Fire Warden of Minnesota, for 1902. By Gen. C. C. ANDREWS. Pp. 132. Illustrated. Published by the State, St. Paul, Minn., 1903.

This is an exhaustive report, not only of the forest fires of the state and the methods for their control, but also of the general progress of forestry in Minnesota and in the rest of the United States in relation to what has been done in the state itself. There are a number of descriptions of European forests and forest policies, and these in their place give object lessons for domestic management. So exhaustive has this report been made that it will prove of service to fire wardens and foresters everywhere.

Eleventh Biennial Report of the State Engineer of Colorado. By ADDISON J. McCUNE. Pp. 334. Illustrated. Printed by the State Printer, Denver, Colo., 1903.

Irrigation investigations and developments form a large part of the report of the state engineer of Colorado, and there is much that is of practical application which will be of service, not only to engineers, but to irrigators as well. Legal decisions on irrigation matters are discussed from an engineering as well as a legal point of view, and the drainage and seepage investigations and the chapters on the measurement and duty of water are particularly good.

Nineteenth Annual Report of the Agricultural Experiment Station of the University of Wisconsin. Pp. 302. Illustrated. Published by the State Printer, Madison, Wis., 1903.

The usual résumé of the operations of one year at the experiment station of a Western State university, with particular phases devoted to the principal agricultural interests of the state. The value of the illustrations, which seem to have been well selected, has been almost entirely lost in this instance because of poor printing. The experiments with grain and forage plants have yielded good results, and seem to be the most important part of the report.

Crataegus in Rochester, New York. By C. S. SARGENT. Pp. 42. Reprinted from the proceedings of the Rochester Academy of Science, and published by the Academy, 1903.

The author has made an exhaustive study of these plants, and besides the bulletin named above has recently published a monograph on "Recently Recognized Species of *Crataegus* in Eastern Canada and New England." Both of these have interest, being purely technical, to any one making a study of this group of hardy plants, which includes the hawthorns, much used in ornamental planting.

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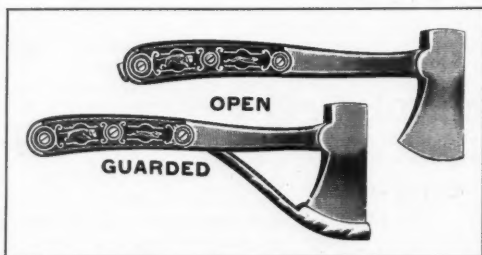
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